THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE OUTLOOK.

IF any of our readers be low in tone and in want of an industrial tonic, they will find it in the *Times* Financial and Commercial Supplement of Monday last. The article on "Progress in the Engineering Trades," though emanating from that interesting anonymous individual "A Correspondent," certainly bears the stamp of authority, and it paints a picture of the engineering development which is upon us in such hopeful colours that the reader has not to proceed far before "catching" the optimism of the writer and being carried along quite merrily with him. "The key-note of 1904 was 'hope'; that of 1905 was 'anticipation,'" and as the year 1905 wore on, order books "began to show a better appearance, but not until well within the last quarter of the year was it generally admitted that trade was brisk and prospects brighter." "Once the change had been fully recognised, a buoyant feeling prevailed, a 'boom' was talked about, and 1905 closed amid almost general congratulations and prophecies of a brilliant year in 1906." This, in brief, indicates the main tenour of the article, though in discussing the outlook for the future the *Times* writer is careful to show that though we are nearing "we have not actually arrived at prosperity," and he suggests that the position is as yet one of some sensitiveness, which might be affected "should a cold wind blow," making the present fair prospect to suffer—"though not for long"—as he adds, ever in the hopeful vein. Without that adverse wind we "may reach it very quickly." All of which and much more in this article affords highly encouraging and very gratifying reading.

Though the writer in these remarks has discussed engineering industries as a whole, he has also touched upon particular departments separately, indicating very briefly the reasons for his buoyancy of spirit. Upon the electrical industry there is not a great deal said save retrospectively, such as "Electrical engineers did not do well in the early months of the year, but demand was better, and on the whole they have not been so badly off." Be that as it may, they are anxious for a revival, and we are pretty confident that electrical engineering and manufacturing will share in the anticipated success of other branches of engineering when it comes. They are in a measure connected with, or dependent upon, most other departments of industry, and are affected towards success or failure by them. In any "boom" that might come, the electrical engineering industry ought to share largely because of its comparatively recent establishment and growth, and its consequent enormous scope. Its representatives are as a class, for the most part, possessed of boundless life and energy, and their profession and trade are favoured by the fullness of opportunity accompanying the youth and ever-increasing applications of electricity, as it finds its way into new spheres.

With the general awakening of trade; with the electrification of some of our railways—suburban, at least—only just ahead of us, if not already within our grasp; with the electrical equipment of works and factories now well in favour and in hand; with more shipbuilding and other work to be done for foreign countries which have to rehabilitate and develop themselves after unrest; with these all requiring a measure of electrical assistance, our manufacturing trade should soon feel itself rising on the "boom" curve. In business circles generally there may come that tone of confidence which promotes business and sets more money available for investment in electrical undertakings; greater industrial activity means an increased spending power on the part of the people, with a consequent ability to avail themselves of the manifold modern domestic applications of electricity. We might indulge in many more such agreeable reflections, and much of this may be in the region of hope, but it is not far wrong if the prophets of a "boom" predict the future with a fair degree of accuracy.

We do not know how far we should be correct in believing that some of our electrical manufacturers have to some extent neglected the foreign markets. Have they been too lax in their business-seeking methods, because they have been led to look for possible assistance in directions that recent events have shown to be unattainable? From what we hear from foreign parts, the measures adopted by British electrical manufacturers in trying to obtain business are not nearly so enterprising as they ought to be. Not twice, nor thrice, but a hundred times has this been urged, by consular agents, by foreign correspondents, and by visitors to this country. Is it too much to suggest that all of our electrical manufacturers should now put forth that boundless life and energy to which we have already referred in moving heaven and earth to obtain the large amount of business that is to be secured by someone in these distant quarters of the globe? The day has not passed when reward await those who are prepared to bear the trouble, sacrifice, and risk of going in eager search for it. And the present, when other suggestions have been put aside, and there appears to be for a time at least a prospect of less controversy and more work, seems to be a proper moment for a gigantic effort on the part of our manufacturers and traders to claim the electrical trading opportunities of the furthermost parts of the earth for their possession.

THE FUTURE OF MUNICIPAL TRADING.

The advent to power of a new political party, or parties, which are known to be imbued with Socialistic views, lends added interest to the question of municipal trading and its future development. That a new impulse will be given to this form of municipal enterprise at the expense of the ratepayers cannot be doubted, especially as the high priest of the doctrine of corporate extravagance has been entrusted with the supreme control of the local authorities. The obvious duty of ratepayers is to pay rates, and we doubt not that they will have every opportunity of doing their duty in the near future—not that such opportunities have been notably lacking in the past. Of late there had been many signs of growing uneasiness on the part of the public, who were called upon to father the many schemes brought forward for the extension of the municipal pay-roll, and they would be well advised in their own interests to bestir themselves still further, for their only safeguards now consist in their united action in bringing pressure to bear on their local representatives on the side of economy and retrenchment, and the unwillingness of financiers to provide the funds for the execution of municipal projects.

The agitation against the unwise extension of such undertakings found vent three years ago in the appointment of the Municipal Trading Committee, whose recommendations in favour of reform in municipal accountancy were admirable in form, but unfortunately lacked the Governmental support that they should have received. It is true that the late Government promised to carry them into effect, and collected information for that purpose; but thanks to their apathy or lethargy, they made little progress in the matter, and by the irony of fate it has remained for their successors, headed by the Right Hon. John Burns, to carry into effect their intention to appoint a departmental committee on the subject of municipal finance, and to reap the credit which they might and rightly should have earned. What will come of the inquiry remains for time to show; we cannot hope for the drastic measures which are necessary if the true position of affairs is to be made clear to the ratepayers, but we trust that some improvement may be made in the present chaotic condition of municipal accounts. They could not be worsened, at any rate.

As for the wider question of municipal trading and its effects upon sound industrial progress, we have grave fears that serious harm will accrue under the new *régime*. Thanks to the absurd fiasco of the dropping of the Administrative Company's Bill at the moment of triumph last year, the Bill has to run the gauntlet again in the coming Session, with the added danger of a Socialist majority in the House of Commons, which, in all probability, will take up a hostile attitude towards it, however easily it may go through Committee. Moreover, the chances in favour of the London County Council's fatuous scheme, which were zero a few weeks ago in view of the Finance Committee's adverse comments, to say nothing of the intrinsic absurdity of the project, have now assumed a rosy aspect, and there is no small probability that the people of London may be saddled, willy-nilly, with an outlay compared with which the loss of £50,000 a year on the futile Thames steamboats, largely due to the efforts of the talented President of the L.G.B., will be as a drop in the river. People who will go ahead with a project when their own financial advisers call a halt, and when there are absolutely no details of the scheme before them, will do anything. Last year they argued that a big power scheme was unnecessary; now they argue that it is indispensable, and that they are the gifted geniuses who alone can carry it out! Verily, it must have been a very long time ago when, in the midst of many counsellors, there was wisdom.

Electrical contractors may now proceed to put their own accounts in order, and to prepare the obituary notices of their businesses; municipal wiring, at less than cost price, subsidised out of the rates, will be their bane. That the customary clause will be brought forward, and that it will get through this time, is a foregone conclusion. But stay—there is the House of Lords! Now is the opportunity of that archaic institution to prove its worth, and to make amends for its absurd mistake in vetoing tramways over the bridges. England expects the Lords to do their duty!!

India-Rubber Gloves v. Boots.

In view of the frequent—all too frequent—deaths by electric shock which have occurred of late years, not only to unskilled labourers, but even to highly-trained and experienced station engineers, it is important that no means of guarding against such disasters should be overlooked. The inconveniences inherent to the use of india-rubber gloves are painfully evident to those who have to use them, and it is not surprising that not seldom they are dispensed with, no matter what the risk.

We have observed that, apart from cases where contact with high pressure apparatus has been brought about unawares, the victim having had no intention of touching or handling the dangerous parts, and where, therefore, gloves would not be worn, there are many accidents due to shock from hand to foot; these are, in fact, by far the most common in the limited class with which we are dealing. Shocks from hand to hand are comparatively rare. Gloves are a nuisance—why not use rubber boots?

We submit that if the *left* hand were gloved, and both feet encased in rubber boots outside the ordinary footwear,

the right hand might safely be left bare and unhampered, thus enabling the most delicate adjustments to be effected with ease and perfect safety. Thus the clumsiness of rubber gloves would be avoided, while a much greater thickness of rubber could be employed in the soles of the boots without interfering with freedom of movement. Rubber mats, of course, are used in front of most switchboards, &c., equipped with high pressure apparatus, but one may step off a mat, whereas one cannot step off one's boots. Moreover, in many positions mats are quite inapplicable. The danger of contact with the head and hand simultaneously is, of course, present, whether rubber boots are worn or not; but shocks from head to foot are prevented. The same is true of other parts of the body, the clothing being of little protection against high pressure shocks; the danger is certainly less with rubber boots. We commend the suggestion to the consideration of station engineers for what it may be worth.

Thermal Efficiencies in the Boiler House.

A very few words are necessary concerning Mr. Bennis's long letter of last week. We, of course, accept, without any hesitation, Mr. Bennis's definition of the thermal efficiency of a steam generating plant (which is the equivalent of what Mr. Booth calls the nominal efficiency), so far as hand-fired installations without special accessories are concerned. But for plants with automatic stokers driven by steam engines or electric motors, we think that Mr. Bennis's formula (which is as orthodox as the seven years' old records chronicled by Mr. Bryan Donkin) requires expansion. To our mind it should be expressed—

$$E = \frac{[W(H - h)] - [a(H - h)]}{w\,C},$$

where E is the thermal efficiency of the plant, W the weight of water evaporated, w the weight of coal burned, C the calorific value of the coal burned, H the heat value of the steam, h the heat value of the boiler feed water, and a is the equivalent weight of the steam used in connection with the steam-raising accessories, as for stoking or scraping economiser tubes. These devices, which, by limiting air leakage at the furnaces, and by keeping combustion temperatures constant, improve the efficiency of the entire steam-raising plant, do, when their maintenance cost is carried back to its logical starting point, in themselves account for a certain fuel consumption on the furnace bars. This item, less, of course, than that of the saving it secures, goes to raise a small quantity of steam which is not actually available in the shape of distributable energy (that is, distributable over a factory or an electricity supply system). Instead, the equivalent steam consumption of these accessories is returned to the boiler in the form of energy, which serves to facilitate the transference of heat from the coal to the steam; the same applies to boilers in which a blast of steam is employed to enhance the draught, or in which a fan is employed to give an induced draught.

Therefore, we would define the thermal efficiency of the combined steam-raising plant in any installation as the percentage ratio which the thermal value of the steam (at the boiler stop valve) actually available for power purposes (apart from the boiler house needs), minus the heat value of the feed, bears to the heat value of the coal burned during the period under examination. Our definition is perhaps an ultra-refinement, but its basis is thermodynamically sound, and is consistent with the spirit in which the sample boiler test (to which we alluded in our first remarks upon this subject) was prepared.

Patent Law.

On another page of this issue we print an article from a correspondent on the patent law. The only error that our contributor makes in matters of fact is regarding the cost of a U.S.A. patent, which is £7, not £10, and is payable in two instalments, £3 on application and £4 on issue. We cannot agree with all the opinions expressed by the writer, but they are all arguable. It has been suggested to us that one way of getting rid of the surplus of the Patent Office might be the raising of the salaries of the officials, but that, we are afraid, is not what the writer of our article means. The Special Patent Court has been often proposed, and after full consideration by various committees, has been rejected. The Patent Office at present does a great deal for the inventor who applies for his own patent, almost as much as the writer asks for; but there is a limit to what may be done in this direction, because other professions, besides inventors, might claim to have all legal work done for them at the expense of the Government. That would be an extension of socialism for which the country is hardly prepared, as yet.

Glasgow Telephones.

The Telephone Department of the Glasgow Corporation has issued a circular regarding party lines—selective and non-selective—with diagrams of 2, 4 and 20-party lines. At the back of the circular is the representation of a pair of scales, in which "Corporation, 10,451" weighs down "N.T. Co., 8,803." The figures are stated to represent the exclusive line subscribers, as shown in the respective Telephone Directories, July and August, 1905, and a foot-note says that "exclusive line subscribers represent the more important firms." The policy of advertising the facilities which a municipal undertaking has to offer is highly commendable, and the object of this circular is obviously intended to persuade the Glasgow citizen to become a subscriber to the Corporation Telephone Exchange. That being so, it is surprising that the Department should run the risk of alienating sympathies of a numerous body by telling the recipient of the circular by means of very bold letters on its cover—"You are a Shareholder. Support Your Own Undertaking." The municipal taxpayer who is "a shareholder" against his will hardly relishes such a reminder, and is unlikely to be brought by such means to "support his own undertaking," though, perhaps, he cannot refrain from asking, "Where are the dividends?"

Electricity and Refrigeration.

Electrically-driven refrigerating machinery forms an almost ideal load for central stations, seeing that its greatest use is in the lightest and hottest parts of the summer days. Mechanical refrigeration is making rapid strides in London, more particularly in connection with dairy work, although it is by no means confined to work of this nature. There is an enormous amount of ice imported for the purpose of refrigeration in provision stores, and from data which has been collected, it is clear that mechanical refrigeration is much more economical than ice refrigeration. In a paper recently read before the Association of Edison Illuminating Companies, by Mr. G. W. Goddard, on the "Relation of the Central Station to the Motor-Driven Refrigeration Machine," some interesting comparisons were given between the costs of ice refrigeration and electrically-driven refrigerating plant. In one case the annual cost of ice refrigerating at a dairy had been £160, this figure being reduced to about £150 by the use of electrically-driven refrigerating plant, the latter cost including cost of power, condensing water and all fixed charges. In addition to the reduced cost there are many advantages given by an electrically-driven plant as compared with an ice refrigerating system, principally in the great convenience and adaptability and in the perfect control of the temperatures, it being possible to regulate the amount of refrigeration to the actual requirements of the material to be cooled. In a grocery store the cost of refrigeration had been reduced from £19 per annum to about £9, by the adoption of electrically-driven refrigeration plant. A remarkable difference in cost was found in the case of a drug store where the cost of ice refrigeration had been £320 per annum, this being reduced by electrically-driven plant to about £200, whilst in the case of a restaurant the cost was reduced from £130 to less than £90. There is probably not the same demand for refrigerating plant in this country as in America, but there is no doubt that for hotels, restaurants, dairies and other businesses in which perishable goods are kept, the cost of a refrigerating plant is very soon paid for by the savings effected due to diminished deterioration.

THE LONDON–GLASGOW UNDERGROUND TELEGRAPH SYSTEM.

(*Concluded from page* 44.)

Types of Cables.—The system from London to Birmingham was fully described in our issue of January 27th, 1899. The cable used in this section of 117¼ miles contained 76 conductors, each weighing 150 lb. per mile. From Birmingham to Warrington the type of cable used was modified by the insertion of a ring of 29 "screened" conductors immediately under the lead sheath. These screened conductors consist of wires weighing 70 lb. per mile, insulated with paper and covered externally with copper ribbon ·003 in. thick. The latter makes electrical contact with the lead sheath throughout each length of cable, so that each conductor is surrounded by an earthed screen which completely shields it electrostatically from the inductive action of currents in neighbouring conductors. The copper tape also acts, though less perfectly, as an electro-magnetic screen, so that although

Fig. 8.—Section of Cable.

these conductors are adjacent in the cable, they may, nevertheless, be worked over long distances without appreciable inductive interference with each other. These screened conductors are intended to be used for local telegraphic communication between the various towns on or near the route of the cable. The cable core inside the ring of screened conductors is made up of 74 conductors, each weighing 100 lb. per mile, paper insulated and laid up in twisted pairs in the usual way. Different lays, or lengths of twist, are given to the groups of pairs in the several layers to prevent the practical parallelism, and consequent mutual interference, which would result from pairs having the same lay revolving together.

In the sections north of Warrington the whole of the cable is of a uniform type, which, however, differs from the type just described in one or two important respects. There is the same layer of 29 screened 70-lb. conductors immediately under the lead, but the inner core consists of 56 100-lb. and 12 150-lb. conductors. The 100-lb. conductors are formed into groups of four pairs each by successive twinning—that is, two pairs are twisted together to form a group of four conductors, and two such groups of four conductors are twisted together to form a group of eight conductors. (The process may be carried another step by twisting two groups of eight together, but this has not been done in the cable we are considering.) The complete core is formed by using a group of four pairs made up as above described as a centre, surrounding this by six similar groups, and placing one pair of 150-lb. conductors in each of the six spaces between these groups and the layer of screened conductors. In a section of the actual cable (fig. 8) it is difficult to distinguish the various groups, but an inspection of fig. 9 will make the arrangement as well as the system of numbering perfectly clear. The layer of screened wires is numbered from 35 to 65. It may be mentioned that the weight of the copper screening tape is roughly equal to that of the enclosed conductor. The electrostatic capacities of the conductors per mile are as follows:—(*a*) 70-lb. screened, 0·12 mf.; (*b*) 100-lb. loops, 0·06 mf.; and (*c*) 150-lb. loops, 0·07 mf. Cables made up by successive twinning are said to be of the "multiple twin" type, and the idea of forming a cable in this way is due to Mr. A. W. Martin, now assistant superintendent of the Eastern District. It is hardly too much to say that ninety-nine out of a hundred cable engineers who had not actually seen conductors stranded in this way, would have regarded the proposal to do so as utterly impracticable. The great advantage of the method is the facility it affords for joining up conductors in parallel, so as to obtain circuits of greater conductivity without increasing the capacity in anything like the same ratio. For example, out of each group of eight wires, we can have four loops with conductors of 100 lb. per mile, two loops with 200-lb. conductors, or one loop with 400-lb. conductors, and in each case the loop, or loops, so formed will be free from inductive disturbance. The system also possesses the advantage that additional circuits may be formed by superposing (or superimposing, as it is commonly called) on the various loops.

For telegraphic communication it is possible to work quadruplex on the 70-lb. conductors up to a distance of 150 miles, and quadruplex plus duplex on any individual pair of 100-lb. or 150-lb. conductors to a distance of over 200 miles, so that the actual number of conductors by no means represents the possible number of channels of communication available. Moreover, Wheatstone working will not be subject to the same limitations of distance, and with "repeaters" at Warrington it will be possible to work at a comparatively high speed from London through to Glasgow.

Jointing.—The two wires of a pair are insulated with paper of the same colour, but the "A" wire is marked by red and the "B" wire by white string. The groups of pairs are wrapped with distinctively coloured papers. The

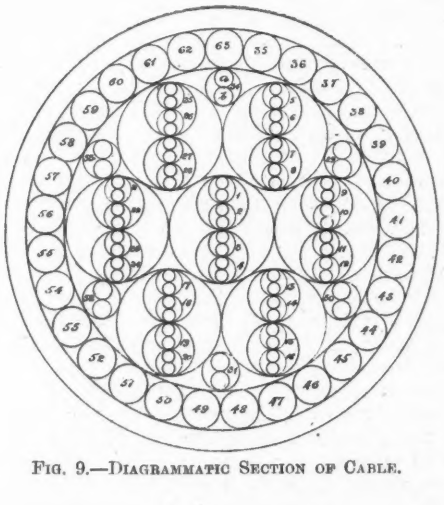

Fig. 9.—Diagrammatic Section of Cable.

method of jointing each eight-wire group will be easily understood from fig. 10. The individual wires are jointed by means of small copper tubes or sleeves, 1 in. long, into which the ends of the wires are passed, the joint being then soldered and a paper sleeve slipped over it; but care must, of course, be taken that a group of wires of one of the cables is connected with the corresponding wires of a similarly formed group of the other, and that wires are not crossed from one core to another. The most convenient main cores may, however, be selected for jointing together irrespective of colours.

In preparing the cable ends for jointing, the cores are first separated, and after two similarly constructed cores (*g* and g^1, fig. 10) have been selected, they are each divided into two pairs of four wires by unwrapping the paper coverings, but these and the subsequent coverings are not entirely removed, as they are indispensable for purposes of identification.

Each four-wire portion is then similarly divided into two pairs.

As each of the differently coloured pairs of wires—red, white, blue or green—is laid up with a distinctive lay, it is necessary to follow a definite plan in jointing the pairs together, in order that the greatest immunity from inductive disturbance may be secured. At each joint the coloured pairs are connected as follows, the colour first mentioned in each case being taken from the side from which the jointing is proceeding :—

White pair is joined to Green pair.			
Red	,,	,,	Blue ,,
Green	,,	,,	Red ,,
Blue	,,	,,	White ,,

Keeping these colour changes in view, a pair of wires on one side is now jointed to a pair upon the other, as a to a^1 in the figure. When this has been done, the second pair, b, of the four-wire core on the one side is joined to that, b^1, on the other; forming a through four-wire core e e^1, all the wires in which should be under one wrapping of paper.

The four-wire cores, f and f^1, under the same paper wrappings as e and e^1 respectively, are now jointed in a

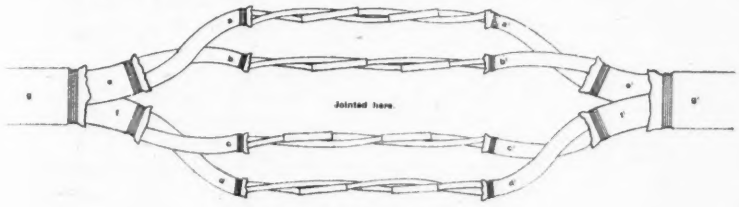

Fig. 10.—System of Jointing.

precisely similar manner—*i.e.*, c to c^1 and d to d^1, thus completing a through eight-wire core, g g^1, all the wires being under one wrapping of paper.

When all the conductors have been jointed and neatly arranged, the lead sleeve is slipped over the joint and carefully soldered to the cable sheath. (The making of a wiped joint on a cable in position is, it may be observed, an operation requiring special skill on the part of the plumber, and many otherwise experienced men fail in this.) The joint is then thoroughly dried by means of charcoal braziers, the air-nozzle in the lead sleeve being meanwhile left open to allow the moisture to escape. If a piece of mirror held over the nozzle remains undimmed, the joint is considered to be sufficiently dry, the opening is closed by soldering over it a tinned copper disk, and the cap is screwed on. The soundness of the wiped joint is tested by putting air-pressure on the cable and covering the joint with a little soapy water. Any defeat in the soldering would be immediately indicated by bubbles in the latter.

The latest and most efficient form of air-drying apparatus used in connection with this work consists of a Lacy and Hulbert's "Boreas" pump driven by a petrol motor mounted with the necessary calcium chloride cylinders on a trolley. The normal speed of the engine is 700 r.p.m., and of the compressor 300 r.p.m., but these can be varied by means of a lever. The specified capacity of the compressor at the above speed is 10 cb. ft. of free air per minute to 30 lb. pressure.

This form of desiccator is much more efficient and rapid in its action than the hand-worked pumps sometimes used.

In addition to the facilities for testing afforded by the pillar test-boxes above referred to, regular test boards, provided with pegs and cords and all necessary testing instruments, are installed at various important points.

Warrington will be a most important centre of the system. It is from this point that cables to Liverpool on the one side, and to Manchester, Leeds, &c., on the other side, branch off. Moreover, as this place is very nearly midway between London and Glasgow, it will probably be found to be the best point at which to install the "relays" or "repeaters" for through working on the important trunk circuits. The introduction of a repeater, as is well known, greatly increases the speed of working of the circuit. Theoretically, if the speed through 400 miles of cable were 100 words per minute, the insertion of a perfect repeater midway would increase the speed to 400 words per minute, that is the speed at which either section could be worked separately, since, other things being equal, the speed varies inversely as the square of the distance. In practice, however, the moving parts of the repeater possess inertia, which reduces the speed considerably, so that the actual speed obtainable in the case supposed would be nearer 300 than 400 words per minute. Again, duplex speed on a given circuit is usually about 35 per cent. less than the simplex speed on the same circuit.

Much of the work of trenching and laying the iron pipes and of drawing in and jointing the cables has been carried out under the most adverse conditions. Up in the Westmorland and Cumberland hills, for example, the engineers and the men under them practically lived on the scene of operations, and were frequently drenched to the skin by the heavy rains which are so prevalent in those parts. They were sometimes flooded out of their tents, and in the neighbourhood of Shap had, it is understood, very lively and unwelcome visitors in the shape of snakes which crawled into the tents. In Scotland the truant schoolboy lent a hand to the work by setting fire to a shed close to which some of the cable drums were lying. Four or five drums were badly burnt. In another case they poked broken glass into the barrels of the drums, and some of it getting between the coils of cable caused some damage.

The strength of national feeling in Scotland was curiously exemplified in the action of a District Committee who objected to the Roman numerals "VII" under the Royal initials E.R. on the pillar test boxes (*vide* fig. 2). Apparently our Gracious King is not Edward VII of Scotland though he is of England. The numerals were chipped off in this district in deference to local susceptibilities.

Errata.—In our previous article (Electrical Review, January 12th, p. 44), fourth line from end, for fig. 6 read fig. 7, and second line from end, for fig. 7 read fig. 5.

A NEW CONDUCTOR FOR HOUSE WIRING.

A modified form of protected wiring for earthed or unearthed installations has been recently introduced by Herr

Fig. 1.

Fig. 2.

E. Kuhlo, chief engineer of the Stettin Electrical Co., and is described in the *Elektrotechnische Zeitschrift*. The method resembles wiring with lead-covered cable or concentric

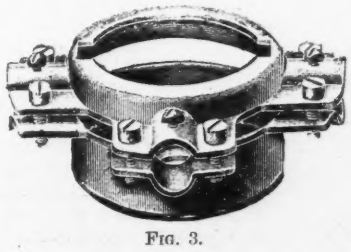

Fig. 3.

wiring, and was devised so as to avoid the objections to the ordinary wiring in metal or insulating pipes. Amongst

these objections are the clumsiness of the piping and the difficulty in bending it and in drawing in the wire, whilst the liability for condensed water to collect in the pipes is a

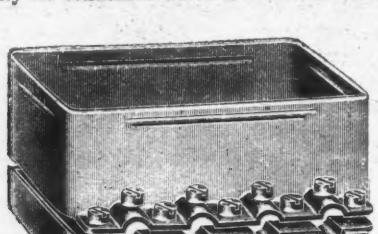

Fig. 4.

source of danger to the insulation. The new wire consists of an ordinary copper core insulated in the usual manner, and then surrounded by a tightly fitting brass covering closed by means of a longitudinal folded joint, as shown for a single-core cable, in fig. 1, and for a three-core cable, in fig. 2. Sometimes a copper or a steel covering is used.

The thickness of the covering is chosen so as to give ample mechanical strength, and a cross-section at least equivalent to that of the copper conductors, whilst at the

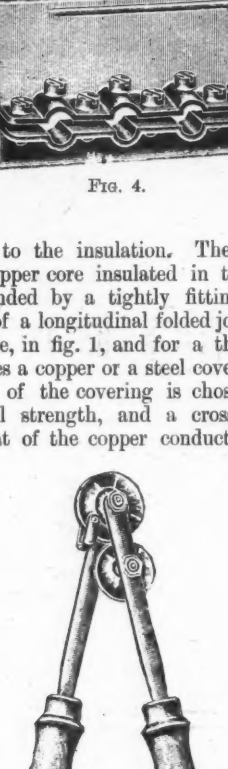

Fig. 5.

same time it is readily bent. The outer tube acts merely as mechanical protection in the case of an unearthed system, but is used as the earthed return in an earthed system, just like the earthed outer in ordinary concentric wiring.

The joint boxes and fuse boxes used with the system are shown in figs. 3 and 4 respectively, whilst fig. 5 shows the bending tool employed for the larger sizes of conductor.

The conductor is made up in convenient rolls of 50 or 100 metres, and is suitable either for laying in plaster or fixing uncovered.

OUR CHANCE IN CHINA.

At a moment when an extraordinarily thorough boycott of American goods has pressed the mercantile population of Shanghai and of China itself towards ruin; when similar measures have been threatened against English trade; when the *Times* correspondent asserts that there is "a widespread determination to grant no further commercial concessions to foreigners, and native companies are being formed to undertake railway and mining enterprises, while a vigorous anti-foreign agitation has been started in the native Press," it may sound strangely inconsistent to suggest that now is the time riper than ever for our merchants, our manufacturers, our agents, and our whole business forces to bestir themselves as never before in preparation for an invasion of the Chinese Empire. The integrity of that Empire is guaranteed by the pact between Great Britain and Japan. That pact, therefore, is the guarantee of the integrity of British trade. But China limps, one hand on the shoulder of each, between Britain and Japan, and depends for progress as much as for protection on the equal marching of both her supporters. With one down or dragging, poor China is in dire peril of her own choicest penalty—death by a thousand cuts; for though the vultures have retired from the carcase upon which they had but just whetted their beaks, when it was snatched from them and resuscitated, they hover each in his eyrie waiting, as vultures can wait, for the rescuers themselves to weaken or quarrel and part. How then fares the integrity of trade, when the ventures of our merchants may depend on the continued good-will, or the continued good health, of the supporting allies? Why, badly, if there is any ground for our belief that Japan works for itself first and itself last. What nation does not?

The integrity of the Chinese Empire and of the trade of the English foreign devils—we don't trouble about the others—would be poorly guaranteed in permanence by the present alliance, because we do not think that the heart of the Japanese people bears us any better will, when it comes to trading and concessions, than does the heart of the Chinese. But this much-talked-of integrity is not going to depend on any borrowed foundations. China, after a period of cordial drinking, cleansing, and throwing off bandages, is going to lean less and less heavily on her crutches, is going to limp no more, and, finally, will walk alone, the proud guarantor of her own inviolability.

That optimistic forecast derives its breath from a perusal of two special articles on "The New Chinese Army," in the *Times* of December 28th and January 1st, and of a leader, based on those articles, in the *Times* of January 2nd.

Manœuvres have been held in the North of China with a "new model" army of 35,000 men. Not a great deal to make a stir about, perhaps, when the population of China proper is something over 400 millions. But the actual numbers are nothing—at present. China has armies of various sorts which may number more or less than a million. Nobody cares much whether that kind of army is innumerable, for it is of no fighting value; but these 35,000 men are the nucleus of a new army composed of real soldiers and real arms—not unpaid brigands handling bows and arrows and gingalls. It is intended that 35,000 shall become 120,000 by the end of this year, and that in 10 years—for which period at least we may expect the Anglo-Japanese alliance to be effective—there will be a standing army of half a million and a reserve of a quarter of a million.

The *Times* rightly thinks that we should be cautious:—"Many accidents may happen in a country like China to prevent the execution of the ambitions designs which our correspondent describes. The party of reaction is powerful, the national prejudices are profound, and official corruption and incompetence are widespread and inveterate. So far the movement is in its infancy, and it may, or may not, grow to manhood."

We, who, by reason of our environments, are almost mentally incapable of thinking in terms so huge as those which express the extent and population of China, cannot quarrel with these cautionary words. None but a son of the Orient can hope to prophesy with any chance of fulfilment the ultimate actions of an Oriental nation, so it would be presumptuous for us to do so, but we can try to interpret the writing on the wall.

For four years already this new army has been in preparation, and for much longer the whole Chinese nation has been struggling to break its white man's bonds. Japan's mastery of Russia has infused a giant's strength into the Celestial Empire, and we may look forward to direction and force being given to that strength within the next decade. The omens are propitious, and China awakes. Stung and lacerated by the cruelty and ignominy heaped upon her during her restless sleep she wakes infuriated against her tormentors, and determined to keep them at arms length, until, perhaps, one day she develops muscles to grasp and crush them.

That is China's dream, but will it be possible out of dreamland to act as she would wish?

This new army is to be paid. It is to be fed, and clothed, and transported. All this is to be done by the Government. That alone means the stimulation, resur-

rection and birth of scores of industries. It means the construction of railways and the making of roads and bridges, for there are no railways or roads or bridges worth speaking about in China. It means the development of collieries, of metalliferous mines, of ironworks, and of all the components of our own lives, which we do not recognise because they are old enough to have been welded into the whole.

If China does not just yawn, turn over on its baby army, and go to sleep again, its awakening will keep the world in work for a century.

How should Rip van Winkle know, when he starts up covered with the rags of a forgotten age, how to set about clothing himself in the modern fashion? It is inconceivable that he should run back into the woods and evolve for himself, through as many ages as it has taken the new world by which he is surrounded, the garments that will fit him to take his place in society. Rather, he will go by night to a tailor in the town, and get himself—awkwardly enough—into his new clothes.

What Japan has done China will do, and we may be sure that Japan will try to do it for China, but our business men can gauge the capacity of that remarkable nation, and will tell us that the crumbs that will fall from her table will fill our stomachs if our mouths are open and in the right place.

Whether Japan or China will be ever sufficient unto themselves, or whether between them they will close the door to the white man whose civilisation they adopted, is a speculative problem which need not trouble us in the least just now. What will be, will be, and all we have to think of is whether the Chinese demand will last long enough to repay us with interest for anything we may spend in organisation, propaganda and tools. Ourselves we cannot doubt that wise and even bold expenditure will come back manifold, and however much the doctrine of the Asiatic League may appeal to the hearts of the yellow and the brown, we cannot bring ourselves to believe that East and West can live apart.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

To our Correspondents.—As our readers are aware, we are frequently asked the name of the makers of such and such a thing, where it can be got, or how it is made; to oblige our correspondents we insert these inquiries in our columns, and forward the replies to them. Many inquiries also reach us, which we are able to satisfy without the assistance of our readers, and when these are not in our opinion of general interest, we reply direct by post.

We make no other stipulation than the usual one, that correspondents shall acquaint us with their names and addresses; we regret to say, however, that not only do some of these inquirers neglect the ordinary courtesy of enclosing a stamped addressed envelope for reply, but in some few cases they give false names and addresses. Why they should adopt this course it is difficult to say; is it excessive modesty, or a natural bias towards dissimulation? Whatever the cause, the natural result is that the letters which we forward to them come back through the Returned Letter Office.

We need not dwell upon the discourtesy to ourselves; we must, however, point out that this indefensible practice constitutes an affront to those of our readers who kindly take the trouble to reply to such inquiries. Our attention has been drawn to the matter by the fact that the person whose inquiry regarding steel strips was published in our issue of the 12th inst., gave a wrong address, and several letters in reply to it have been returned. Obviously, the inquirer thus deprives himself of the possibility of reply, and his crime brings its own punishment; but this does not compensate our correspondents and ourselves for the time and trouble expended in vain.—Eds. E.R.

Electric Lifts.

Our attention has been drawn to the article in your issue of January 5th by Mr. Percy Good, on the comparison between the working cost of hydraulic and electric lifts, and we notice that the figures there given are based on tests taken by means of a dead-beat ammeter when the lifts were running, with an estimated allowance for starting current.

We would suggest that the most efficient method of testing the cost of working electric lifts is that which is now adopted by the majority of consulting engineers in preparing specifications, viz., by running the lift with a specified load for a definite number of journeys, and taking the current consumption actually registered on the meter.

We have fitted several lifts for the North-Eastern Railway Co. under a specification of this character, and the following results have been obtained when the machines were tested by their engineers:—

	Load. cwt.	Speed. ft.	Travel. ft.	Travel. in.	Trips per B.T.U.
Hull Station Hotel, passenger lift ...	10	200	31	9	37½
Hull Station Hotel, luggage lift ...	10	150	41	9	28
York Station Hotel, passenger lift ...	10	200	42	0	25½

The machines at Hull Station were fixed overhead, and at York down below, which accounts for the slightly higher efficiency of the Hull lifts.

If the consumption is worked out on the same basis as in Mr. Good's figures, taking the travel at 33 ft. 9 in., or half of the full travel of 67 ft. 6 in., the figures shown in our table will equal about 4·5 B.T.U. for 150 journeys, as compared with the estimated figure of 4·7 given in his article, which, of course, closely confirms the figures suggested by him, based upon estimated consumption.

We note that in working out the comparative cost, he suggests taking 150 journeys per day, half the height of travel and with half load; we think, however, that in a busy office building the consumption would considerably exceed this.

If it were taken out at 150 full journeys, travel 67 ft. 6 in., load 10 cwt., we should base the figures as follows:—

Hydraulic Lift.—Consumption, 7 gallons per complete journey; 150 journeys × 7 gallons × 78 days per quarter; 81,900 gallons per quarter, which on the Hydraulic Power Co.'s scale would cost £13 12s. 6d. per quarter.

Electric Lift.—The same number of journeys with the electric lift, taking either full load up and down, or half load up and down (which would give practically the same results as regards the consumption), and taking current at 2d. per unit, which we think is nearer the average than 2½d., would give a cost of £5 17s. per quarter. Showing a saving of £31 2s. per annum in favour of electric power.

It should be borne in mind, however, that with an increased water consumption, owing to a number of lifts being used, the comparison becomes more favourable to the hydraulic lifts.

For instance, if there were three similar lifts in the same building, or in the same ownership, the cost of water would become £30 16s. per quarter, and the cost of current £17 15s. per quarter.

Mr. Good, in his article, ignores the question of first cost, but inasmuch as this would, perhaps, be 50 per cent. greater in the case of electric lifts, the extra allowance for interest and depreciation on the extra outlay should, of course, be added to the cost of current, in order to arrive at a really fair comparison as to the relative advantages of the two systems.

R. Waygood & Co., Ltd.

London, *January 19th*, 1906.

Armature Coils and Nitric Acid.

Referring to Mr. Patchell's reply at the I.E.E. to the letter I addressed to you on the above subject in your issue of the 22nd ult., may I be allowed to point out that Mr. Patchell is certainly under one misapprehension in this matter, namely, that his criticisms have given rise to ill-feeling. This is certainly not the case as far as we are concerned. As a matter of fact, we regret very much that on account of the manner in which the matter was raised by Mr. Patchell, we had no alternative but to take notice of it, and to give the utmost publicity to

the true facts of the case with the help of the technical Press.

As for the reply itself, I will leave it to those who have followed this matter to form their own opinion as to whether the interpretation I and others gave to Mr. Patchell's remarks was correct or not, and as to whether there was justification for objecting to these remarks. The whole point of my letter is fully borne out by Mr. Patchell's reply, namely, that without knowing the facts and details of the case, Mr. Patchell advances certain opinions as to the causes of the trouble (which causes, as a matter of fact, have never been in doubt), and that these opinions, if allowed to go uncontradicted, do a grave injustice and injury to the builders of the machines, who, I may take this opportunity of stating, were pioneers in three-phase work, and were building 10,000-volt three-phase plant at least seven years before the Bow plant was thought of.

In reflecting on this matter, I recall the remarks of a well-known American engineer, made during the discussion on an (American) Institution paper not long ago. In dealing with an allied subject (A.I.E.E. *Journal*, Vol. 22, page 369) he stated :—"The building and testing of high tension apparatus, transformers or generators, is an extremely intricate and complicated problem, and no person who has not worked on a design and used such material can have any real appreciation of the difficulties involved."

These remarks are certainly applicable to the present case, and I doubt if few outside manufacturing circles really realise what it means to build two-phase plant at what is practically 15,000 volts for climates such as that of London.

I read Mr. Duddell's remarks on the question at issue between Mr. Patchell and myself with great interest ; they show a real knowledge of some important considerations which have to be taken into account in connection with the question of the slot insulation of such high-pressure machines. In this connection, I would like to point out that the slot insulation in the Willesden alternators never gave the slightest trouble in itself ; the whole trouble at Willesden was due to the destruction of the insulation of the individual turns by the formation of nitric acid—and this in spite of the fact that the conductors were heavily braided, and that the pressure between adjacent layers never exceeded 14 volts. Apart from Mr. Highfield, it would appear from the report of the discussion on Mr. Patchell's paper that not one of the speakers (the author of the paper included) properly appreciated this point—namely, that the slot insulation never gave any trouble, and was not acted upon chemically as far as we know, and that the breakdowns which occurred were due solely to the short-circuiting of adjacent turns, with the consequent burning and damage to the slot insulation.

A. C. Eborall.

London, *January 22nd*, 1906.

New Method of Electrical Storage.

I have the misfortune to be the manager of an electric supply company carrying on business in a Continental health resort where our consumers' chief occupation is to find fault with the electric supply. I have collected quite a variety of the usual kind of complaints, but I think that for ingenuity the following is unique :—As our consumers wished for "more light from their lamps," we recently raised the pressure so as somewhat to over-run the lamps. It is now stated that "it is disgraceful for a company to fraudulently raise the pressure, because the meters being made for the stated pressure, can only pass on this intensity to the lamps, and, therefore, the excess remains in the meter to turn it round and put money into the shareholders' pockets."

W. A. B.

How to Screw Conduit.

We have observed the letter written by Mr. Schmahl, of the Armorduct Co., in a recent issue on the above matter. We consider that the manufacturers of steel conduit have adopted a standard size and thread which, for a number of years past, has met the approval and requirements of the electrical trade, and these sizes and threads are regarded as the standard.

We also consider that the standard heavy gauge tubes, such as are supplied by this company and which are identical with those of most of the other makers, are sufficiently heavy to meet all the requirements and contingencies of electrical wiring. Although we find a fairly large demand for screwed conduits of a lighter gauge than the heavy, we do not recommend their use.

We entirely disagree with the conclusion at which Mr. Schmahl has arrived as to the adoption of gas sizes, and we fail to see that any advantage whatever is to be gained by increasing the gauge of the tubes beyond the standard heavy. Why, therefore, should gas sizes be used ? Is it because a few who have lately joined the list of electrical contractors want to utilise their old tools, or is it that Mr. Schmahl is only dealing in gas size tubes ?

For the **Metallic Seamless Tube Co.,**
F. W. Bayliss, *Director.*

Birmingham, *January 23rd*, 1906.

Warning.

It may be well to let the following facts be known. A man giving the name of John Forsyth, of Park Hall Farm, Althorpe, Northampton (said to be a stud farm on Lord Spencer's estate), called on me last week mentioning the name of some clients of mine as having advised him to see me. He stated he wanted his place lighted, utilising for the purpose an existing gas engine, and went very circumstantially into details with a good deal of local colour thrown in. On leaving, he asked his best way and the fare to Westminster, and, of course, found he had not enough cash with him. In such a case, one is placed in a position in which it is impossible not to meet the necessity by a few shillings. On inquiry it was found that no such address or person of the name existed, thus putting me to the loss of a day and expenses.

I found it to be correct that my clients had referred him to me, which, of course, they had done in the ordinary course, quite unaware of the man's character.

He is of rather rough exterior, but educated, about 58, thin-featured, with brownish and partially white hair and whiskers, medium height, wearing a long ulster and hard round hat.

Any engineer at whose office this man may turn up would do a service to the profession if he would detain him and telephone for me.

H. D. Wilkinson.

London, E.C., *January 23rd*, 1906.

Milan International Exhibition, 1906.

In the letter which appeared in your issue of December 15th, 1905, a strong appeal is made by the writer, Mr. Serena, the Hon. Executive Commissioner, British Section, for British manufacturers to be represented at the Italian Exhibition. It is pointed out that "it is a great commercial opportunity for Manufacturers," but that indifference on the subject prevails in this country, and that, as on previous occasions, "we shall make a display unworthy of our industrial greatness, unless there is an awakening at the eleventh hour."

I am not aware to what extent British manufacturers have responded to the invitation to be represented at the Exhibition, but if the experience of my own firm in this matter is any criterion, I am inclined to think the "indifference" is justified.

At the beginning of October, 1905, our firm entered into negotiation for space in the Machinery Section, and were informed there would be a large exhibit of machinery in motion in the Working Hall for Industrial Arts. We applied for space, but were then informed that our machine could not be admitted to that section, as we did not "produce a finish product." We then asked if we might show in the General Machinery Section, or wherever stationary steam boilers were located. The reply was, we could go in the Electric Transport by Land Section, Category 1—Generating Plants.

We were next informed that only locomotive boilers were to be shown in this section, and Marine Boilers in the Sea Transportation Section, and we could have space in this latter if we desired it. We did not think this suitable, and again asked to be included in the General Machinery Section, but our application form was returned with the intimation that boilers will not be admitted in any of the sections unless they are of the marine type or for locomotives, and there the matter ends, so far as we are concerned, after a voluminous correspondence extending over three months.

To me it seems inconceivable that, at an Exhibition of the importance the one in question is said to have, the steam boilers shown should be limited to the two types referred to, in view of the present and prospective improving trade conditions in industrial concerns throughout Northern Italy.

We have had some experience at Exhibitions, having been represented at most of the important shows in various parts of the world during the past half century, but in this case it is unique. Of course, the case of our firm may be exceptional, but I think your readers will agree that such experience is not conducive to British manufacturers going to the trouble and expense of exhibiting abroad to combat foreign rivals. I also understand that a firm of electrical engineers have received the sole right of supplying the power on the understanding that no other firm is allowed to show generating machinery. This mode of dealing does not seem to be right in the case of an Exhibition. What, might I ask, is the use of the British Government granting a subsidy of £10,000 towards the cost of a British Section, with conditions as above related?

Frequent Exhibitor.

British Canals.

With reference to the note headed "Our Canals" in your issue of the 5th inst., it goes without saying that any attempt to purchase the canals by compulsion at actual value would meet with great opposition from their present owners. May I suggest, however, that the formation of a Canal Syndicate, under some amount of Government control, perhaps, in which railway companies and others who are now owners could be allotted shares in proportion to the actual value of their canals, might prove acceptable. This would secure to the railway companies a fair proportion of any profits arising from the working of the canals, and would probably ensure their co-operation in the schemes for the improvement of our waterways, whilst at the same time it would introduce an element of competition which would undoubtedly tend to the bettering of our railway facilities.

Charles Dean.

Stoke-on-Trent, *January 22nd*, 1906.

Protection in Excelsis.

The point which Mr. Byng and others stumble over is the fallacy that foreign competition displaces labour. In the first place, I should like to point out that such Protectionist countries as Germany, Spain, Italy, Russia and the United States have large armies of unemployed, and also that even Protectionists desire to build up a big export trade, which can only be done by building up a corresponding import trade, to pay for it. Furthermore, if foreign competition displaces labour, what about home competition? Why not restrict all the London market to London firms. Let us put a tariff wall round each town, and then see whether there will be any unemployment.

Mr. Byng tries to prove that the larger the percentage of labour employed in making an article the less unemployment there will be. How is it, then, that Mr. Byng uses as much labour-saving machinery as he can, and why is it that unemployment is no worse than it was in the days of the hand-loom weaver and hand-made goods generally?

As a matter of fact, we none of us have as many things as we want: and the more goods there are in this country, whether produced at home or given to us by the benevolent foreigner, the better we shall be pleased. *Sudden* changes in imports or exports will have a slight temporary effect on employment—sometimes good, sometimes bad; but in the long run unemployment is due to the attempt of trade unions to enforce a standard wage for good and bad alike, to unwillingness to work, and by the inability of capitalist and worker alike to adapt themselves to the changing wants of the consumer.

As regards the payment for imports by capital, the fact is that during the 10 years ending 1902 we imported on an average £6,000,000 more bullion and specie per year than we exported.

In the example of international trade given in your issue of January 12th, I did leave out of account the effect of tariffs and freights, because these things do not affect the main principle, but like dams erected in the course of a stream, they may change the rapidity and even the direction of flow. The effect of tariffs and freights is very well shown by the accompanying diagram. The left-hand portion of the diagram represents, say, England, and the right-hand portion Germany, all other countries being excluded to simplify matters. In both cases S and D are the supply and demand curves for some one article in the respective countries. That is to say, S shows the relation between the quantity and the price with which the home manufacturers can supply. D represents the relation between the quantity and the price which the home consumer is willing to pay. If there is no intercourse between the two countries M and P

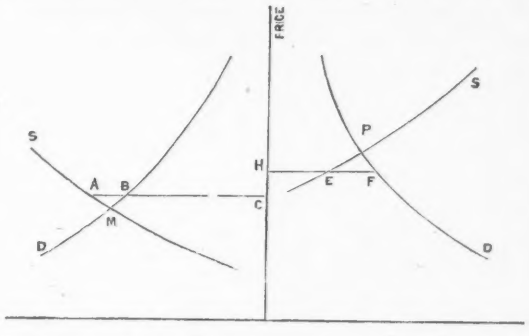

Diagram Showing Effect of Tariffs and Freights.

represent the prices and quantities produced in the two countries. Now let there be an export trade to Germany, H C being the amount of the tax and freight per unit quantity. Then the normal level of prices in the two countries will differ by this amount, and since the export from England is equal to the import into Germany, we see that England produces A C, consuming B C and exporting A B, whilst Germany consumes H F, of which H E is the home production. If the tariff is raised high enough, trade is practically prohibited. The effect of the tariff and freight, as will be seen from the diagram, is to increase prices in Germany, and decrease them in England. Very occasionally the curves S may be inclined the other way.

"Free Trader" asks me if I consider that foreigners have the same ridiculous notions as regards Protection. The Socialists in Germany, most of the Democrats in America, one party in Australia, the Premier and many of his followers in Canada are Free Traders. I have only had personal experience of America, but I have no high opinion of the Americans' knowledge of economics. An American can see a very long way down a straight street, but not far round a corner. In other words, he is keen but narrow.

As regards our great Colonial markets, some misconception exists. The percentage of our exports going to British Possessions for the five-year periods up to 1900, beginning in 1860, were 33·2, 27·6, 25·6, 33·0, 34·5, 35·0, 33·4 and 34·1.

Frank Foster.

Manchester, *January 21st*, 1906.

[At the special request of our correspondent, we insert this letter, lest, as he says, by its omission, it might be inferred that he could not reply to the questions put to him.

Since we wrote the foregoing lines, several other letters have been received. "T" points out in reply to Mr. Jas. Forster, that *export* duties cannot be imposed in the United States without an entire revision of their Constitution—an improbable proceeding.

"We Are Seven" (Birmingham), replying to the same

letter, with reference to the statement that America would not take a tax upon foreign wheat lying down, asks what we can do when America puts a tariff upon our manufactures, making it practically impossible for us to send electrical manufactured goods into their country. We have to take it lying down, as we have no means of retaliation. He also states that it is absolutely against the American Constitution to impose a duty upon exported goods, and to alter this is practically impossible. Germany, France, and other protected countries can buy cotton, copper, &c., from America at the same price as ourselves. How is it there is no export duty put on these articles by way of retaliation against the countries mentioned ?

"A Manufacturer and Tariff Reformer," as we go to press, writes pointing out the same fact.

This correspondence is now closed.—Eds. E.R.]

Thermal Efficiencies.

While admiring your endeavours to put a check on the extravagant claims of manufacturers and others wishing to sell their goods, and being duly grateful for the same, I consider Mr. Bennis has not received fair play at your hands.

Your current leading article states that the question at issue is that of the feasibility of securing a thermal efficiency of 85 per cent. Why, Sir, obviously it is possible ; and, under *certain circumstances*, no difficult matter either. Nor are these circumstances far different from what Mr. Bennis states in your "Correspondence" columns. His keynote is high furnace temperatures ; whether or not these temperatures were detrimental to the boiler he did not discuss. His other conditions were up-to-date improvements in steam-raising plant

Now, taking the Erith's Engineering Co.'s delightfully elementary method of arriving at *possible* efficiencies with which your current leading article appears well pleased, and remembering these two conditions of Mr. Bennis, our furnace temperature at once rises above 3,000° F., and our chimney gases are brought considerably below 400° F.

We all know that in these days of various kinds of mechanical draught, it does not matter in the least what difference of temperature exists between the chimney gases and the atmosphere. The draught will still be maintained, and can be regulated as desired.

If an instrument is used to show when the right amount of air is being admitted, and the stoking is theoretically correct, there is no reason why the chimney gases should escape at a higher temperature than 200° F. or 300° F., after passing through superheaters, economisers and many other modern heat-extracting devices.

Taking, then, the Erith's Engineering Co.'s suppositious case, and altering only their 400° F. limit to 200° F. above the atmosphere for the exhaust gases, we at once see that the chimney losses are reduced to 6·6 per cent. Then if the other heat losses are only 6·7 per cent., the total thermal efficiency *possible* (I admit *unlikely*) comes to 86·7 per cent. If one takes no account of the life of a boiler, the furnace temperature can be raised considerably above 3,000° F. And so I consider that Mr. Bennis's tests are not only possibly correct, but quite probably so.

I ask Mr. Bennis if he ever did claim 88·1 per cent. efficiency for a boiler alone, as stated by Mr. Booth, or were his words misunderstood ?

Percy St. George Kirk.

Castlecary, *January 22nd*, 1906.

I much regret the personal tone adopted by Mr. W. H. Booth in his letter published in your last issue.

His statement that I and my firm's representatives have "pursued him," &c., is due to an entire misconception on his part.

I may here add, and I trust that the addition will console Mr. Booth, that the words "irresponsible scribbler" were not intended to apply to him. It stands to reason, on that gentleman's own showing, that I should scarcely have quoted him in *support* of my claim, as I did in my letter which appeared in yours of the 12th, where I refer to him as "Mr. William H. Booth, M.Am.Soc.C.E., the well-known authority on these matters," had I intended to apply to him the derogatory epithet of which he complains.

Let me put the crux of the controversy in ledger form :—

My contention.	*Mr. Booth's proof.*
Working in connection with an economiser a good type of mechanical stoker and a superheater as much as 85 per cent. can be utilised.	Extract from report of test made September 20th, 1905 :— "Overall efficiency economiser, superheater and boiler 86·342 per cent."

I think this proves my case.

Mr. Booth's statement that I quoted his test in support of a trial made at Brighouse is, like his previous statement as to being "pursued," &c., erroneous.

I quoted his figures in support of the contention in my paper read at Huddersfield that 85 per cent. could be obtained under favourable conditions. The Brighouse result had not been mentioned in the present correspondence until he dragged it in. As he has done so, however, I would point out that we state clearly in the pamphlet to which Mr. Booth calls attention that all water was measured by Siemens meter, and we stated in a letter published in your issue of September 15th last that this test "was made solely to establish to the satisfaction of that firm, the *relative* efficiency and cost of evaporation at their works by hand-firing and by our machine stoker."

We considered that this inference would naturally be drawn by anyone who noted our statement that this method of measuring the water was used.

The ratio which Mr. Booth describes as the "real efficiency" does not appear to us to be of any practical value. For instance, if a very large excess of air be admitted to the boiler, thus lowering both the initial and final temperatures of the gases, the "real efficiency" might rise, whilst the useful efficiency as defined in my letter of last week would be very much lower than if the correct amount of air were admitted and ordinary combustion temperatures obtained.

Mr. Charles Erith's letter, I am glad to see, quite corroborates my statement that high furnace temperatures give high efficiencies. He objects, however, that high temperatures involve prohibitive working cost and depreciation. Similar arguments were used against high pressure steam, and its introduction was thus seriously delayed in many parts of the country. The experience of many years' use of the same much dreaded high temperatures with the Bennis machines has shown that this objection does not hold good with them.

In conclusion, I should like to express my sincere regret that an inquiry into a question of engineering should have been converted into personal quarrel. No, "quarrel" is not the right word, for it takes two to make one, and I have no grievance whatever against Mr. Booth, although he, most unfortunately, thinks that he has one against myself.

A. W. Bennis, M.I.Mech.E.

Bolton, *January 23rd*, 1906.

[We congratulate Mr. Bennis on his conciliatory attitude. We cordially agree with him that personal matters should be avoided in discussions on engineering topics.—Eds. E.R.]

Technical Instruction.

Dr. Walmsley, of the Northampton Institute, Clerkenwell, is reported to have said at the recent Conference of Technological Teachers convened by the L.C.C. "that prior to the establishment of a trade school in any locality the employers should be thoroughly canvassed concerning the requirements of the trades of the district." Might not the same be said with respect to every technical institute ? The writer believes that if this were done the employers would take a much greater interest in their apprentices than is done at the present time. In how many cases is it the fact that the teacher of a technological subject, with a couple of science degrees after his name, has in the eyes of the *employer* no real practical experience. The employer is more likely to believe in technical training when it is imparted by one who knows by actual experience the requirements of the trade. A short time ago one of the engineering institutions desired to get a member of its council to represent the

interests of a particular branch of engineering in a new mechanical engineering technical institute then building. The effort was unsuccessful, as no *outsiders* were wanted on the governing body.

It may be of interest to note that at the *Engineering* Institute in question, one of the general engineering physics classes has drifted into becoming a preparation class for some Board School teachers who desired to enter for a London University (Science) Examination ! ! !

Engineer.

LEGAL.

Action by Messrs. J. Defries & Son, Ltd.

On Wednesday last week in the King's Bench Division, High Court of Justice, judgment was given by Mr. Justice Walton in the action brought by Messrs. J. Defries & Son, Ltd., of Houndsditch, E., to recover from Mrs. Brown-Potter and Mr. Gilbert Hare the sum of £154 for work done and goods supplied for the presentation of "Du Barri" at the Savoy Theatre. The goods consisted of electroliers, which were used for a particular scene, and also for brackets.

Mrs. Brown-Potter having become bankrupt, and her debts becoming capable of proof, the action was against Mr. Gilbert Hare only. This defendant said he had nothing to do with the financial part of the theatre, and had never given authority for his credit to be pledged in any way.

His Lordship said he acted on the assumption that the business of the theatre was carried on by Mrs. Brown-Potter for, and on, her own account, and for her own benefit, and Mr. Hare was not in any sense a principal or partner. He held that Mr. Hare was only in the employ of Mrs. Brown-Potter as an actor, and also as joint manager of the theatre, and as such was not liable for the amount claimed. Then plaintiffs said the defendant held himself out as a principal and, therefore, he was liable; but his Lordship came to the conclusion that he had not done so, and he, therefore, entered judgment for the defendant, with costs.

Swansea Corporation *v.* National Telephone Co.

This case came before the Appeal Court on Monday for further consideration of the questions referred to Major Cardew, the referee appointed by the Court.

Mr. Danckwerts, on behalf of the company, suggested the following additional question:—Whether, in order to afford all proper facilities for the transmission of telephonic messages between persons using the systems of the Telephone Co. and the Corporation in Swansea, junction wires in sufficient numbers should be laid between all or some and which of the company's and the Corporation's exchanges, and whether they should be one-way wires, that is to say, one set of wires to be used for calls from the company's subscribers to the Corporation's, and another from the Corporation to the company, and whether such junctions should be enclosed in cables in sets or how otherwise.

Mr. Buckmaster, K.C., took exception to the form of another question which seemed to leave it to the referee to decide whether if the provision of additional wires from the Corporation's Central Exchange to the company's sub-exchanges was found necessary, it should be made at the expense of the company or of the Corporation.

Lord Justice Vaughan-Williams said they had not meant to suggest any such question.

Their Lordships amended this question in the sense desired by Mr. Buckmaster, and admitted the additional question proposed by Mr. Danckwerts.

Private Wire and Telephone Installation Co. *v.* Portman & Co.

At the Westminster County Court on Monday, Judge Woodfall gave his deferred judgment in this case, where, as already reported, about £30 was claimed in respect to rent due for the use of wires.

In giving judgment, Judge Woodfall referred to the fact that in 1901 the Consolidated Co. laid the wires between the defendants' offices and their own premises, for which the defendants were to pay the rent, and in or about 1902 the present plaintiff took over the business of the Consolidated Co. Under the contract of 1901, the rent being payable in advance, the defendants continued payments for two or three years, and the rent payable in April, 1905, was the rent sued for. The defendants said the plaintiffs were not entitled to recover it, because the contract was illegal and void under the Act of 1869. The first point was whether this was a private wire laid solely for the use of the private business of the defendants, or whether it was a private wire between the defendants and the other parties. Were these three other parties, in fact, in business generally with the defendants, or were they acting independently? He could come to no other conclusion on the evidence before him, but that they were acting quite independently of the defendants. He thought that the contract was in contravention of the Telegraph Act of 1869. Notwithstanding this, the plaintiffs said they were entitled to enforce their contract, first, on the ground that what was prohibited by the Act was not the "laying of the wires." To him it seemed that a person supplying another with a means of breaking the law could not be heard in a court of law to enforce a contract for payment for such means so supplied. It was left to him to put a construction as to what was the prohibitive part of the Act, and he could not come to any other conclusion but that this Statute intended to prohibit any such contract as the plaintiffs sought to enforce. Therefore this contract was in direct contravention to the Act, and one which they could not enforce, and under these circumstances he found no other alternative but to give judgment for the defendants, with costs.

Tramway Compensation Cases.

At the Glasgow Court of Session last week it was stated that the claim by one John Buchanan for £500 damages for personal injuries sustained while travelling in a Glasgow Corporation electric car had been settled by the Corporation paying pursuer £150 and expenses. The car in question was brought to a standstill suddenly, and claimant was thrown against a glass door and injured. It was pleaded that the motorman stopped the car with the hand-brake because the lifeguard had fallen.

At the Preston County Court on 23rd inst., the Preston Corporation were ordered to pay £75 damages to Mrs. Hindle for injuries sustained by her when travelling in one of their cars. She was thrown to the ground by a sudden jerk.

Seizure of Goods Sent for Sale.

On Wednesday in the King's Bench Division, High Court of Justice, Mr. Justice Sutton tried an action brouht by the British Prometheus Co., Ltd., of Kingston-on-Thames, to recover from Mr. Frank E. Tanbridge, of 19, Gower Street, Swansea, damages for alleged wrongful conversion of plaintiffs' goods by the defendant. Plaintiffs are the manufacturers of electrical heating apparatus. Defendant denied that the goods were the property of the plaintiffs, and said they were rightly seized, and sold by the defendant under a distress for £25, being two quarters' rent due March 25th, 1905, from Messrs. E. A. Welch & Co. to the Smith Premier Typewriter Co., in respect of a shop at 3, Mount Street, Swansea. The goods were sold, but were insufficient to pay the rent and expenses.

Mr. H. St. John Raikes was counsel for plaintiffs, and Mr. Bailhache appeared for defendant.

Mr. Raikes said the goods were sold to Messrs. Welch & Co., but his submission was that they passed back to the plaintiffs, and that from March 11th they were only held by Welch & Co., as agents for and on behalf of the plaintiffs. Welch had disappeared from Swansea, taking away his personal belongings, but leaving the plaintiffs' goods in the shop, they being the only stock there. As rent was owing, the defendant, acting for the landlords, distrained and seized the goods, and they were sold for the rent due. If Welch did not hold the goods as agent for the plaintiffs, the plaintiffs had no cause of action.

Mr. Bailhache submitted that there was no case in which such goods, under such circumstances, were exempt from distress.

His Lordship said he was quite clear in this case that his judgment must be for the defendant, with costs.

BUSINESS NOTES.

The Universal Electrical Directory.—The 1906 edition of this Directory will be published in the course of next week.

Consular Notes.—Japan.—The United States Consul at Kobé, in a recent report, states that the opening of the Hanshin Electric Railway between Kobé and Osaka marked a great advance in electric traction in Japan, this being the first line constructed in that country to connect two large cities. The railway is operated on the overhead trolley system. The plant capacity is 1,600 kw. The system covers a little more than 19 miles. There are in use at present 18 cars, which were made by the Nippon Sharyo Seizo Kaisha, of Naeoya, Japan, from a sample car imported from the United States. The cars are well made, and have a seating capacity of about 50. The rails were imported from Pittsburg, U.S.A., and the electric motors from Schenectady, U.S.A. The line is divided into four sections, the fare on each section being 1½d., and these are sub-divided into ¾d. journeys. All told, there are 30 authorised stopping places between the termini. The average time taken on the journey is about 1½ hours. There has been much speculation as to whether the new competing service will greatly affect the traffic between Kobé and Osaka on the Imperial Government Railway. Besides the difference of fares, which are 5d. on the tram and 8½d. third-class and 25d. first-class on the steam cars, the electric cars run every 12 minutes against every hour on the steam railway, and have 30 stopping places as against 3. It is more than probable that the new line will cause a very considerable diminution in the receipts of the Government railway between these two cities. The amount of paid-up capital in this company amounts to about £148,500. The *Kobé Chronicle* of recent date, remarking on this question, says that it looks as if

there will be a boom in electric railways before many months are past. The Government railway passenger traffic between Kobé and Osaka has been so much affected by the Electric Railway, that the Imperial Railway bureau is considering the advisability of establishing an electric line between the two cities, to meet the competition. The bureau is also considering the establishment of such a railway between Tokio and Yokohama, to forestall enterprise. This competition may be bad for the railways which suffer by it, but it is all to the benefit of the travelling public.

Abyssinia.—In the report of the German Commercial Mission to Abyssinia, it is stated that some telephone lines exist between Adis-Ababa and the chief towns of the interior, but these lines are not at present available for public use. For communication with the northern provinces, Erythrea, and thence to Europe, the telegraph line from Adis-Ababa to Asmara, which was built and is controlled by Italians, is most important. The line proceeds from Adis-Ababa in an easterly direction to Ankober, thence in a northerly direction to Noro Ailu. From this place a telephone line is being constructed to Gondar, which is completed as far as Debra Said, the chief town of the province of Wollo Galla. There are telegraph stations at the following places:—Buru Mieda, Marto, Aschangi-Kuoram, Makalle, Adua, Gundet, Adi-Quala, Adi-Ugri, and Asmara. At all these stations there are Italian officials.

Parliamentary.—On Thursday last week Messrs. Campion and Jeune, the Examiners of Standing Orders, commenced the consideration of the Private Bills deposited for proofs of compliance with Standing Orders. Amongst the Bills which were found to have complied with all the requirements were the Charing Cross, West End and City Electricity Supply Co. (Power Supply), St. Pancras Electricity, Shoreditch and Stepney Electricity, Manchester Corporation, Folkestone and District Electricity Supply, and Corporation of London (Blackfriars Bridge).

On Friday, amongst the Bills which passed were the Metropolitan Railway, Administrative County of London and District Electric Power Co., South Lancashire Tramways, North-West London Railway, West London Electric Undertakers' Association, and the Shropshire, Worcestershire and Staffordshire Electric Power.

The Examiners sat again on Monday, when Standing Orders were found to have been complied with in the case of the following unopposed Bills.—Todmorden Corporation; London Outer Circle Railway; Cumberland Electricity and Power Gas; Hammersmith, City and North-East London Railway; Haslingden Corporation; North Metropolitan Tramways; Wigan and Heysham Railway; London Southern Tramways; Lancashire Electric Power; Twickenham and Teddington Electric Supply Co.; London County Council (Electric Supply); and Newcastle-upon-Tyne Electric Supply Co. (Additional Powers).

The Examiners sat again on Tuesday, when the following Bills were declared to comply with Standing Orders:—Metropolitan Electric Supply Co.; Mersey Railway; Metropolitan District Railway; London Electric Supply Corporation, Ltd.; Additional Electrical Power Supply (London); Metropolitan Pneumatic Dispatch Co.; County of Durham Electric Power Supply Co. (Further Powers).

On Wednesday the Examiners found that Standing Orders had been complied with in the case of the following Bills:—Oldham and Saddleworth (abandonment); South Wales Electrical Power Distribution Co.; Baker Street and Waterloo Railway; City of London Electric Lighting Co.; Newport Corporation; Kent Electric Power; Southport and Lytham Tramroad; Hackney Electricity.

On Tuesday Lord Onslow and Sir Chandos Leigh (the Speaker's counsel) sat to decide which of the Bills coming before the next session should originate in the House of Lords and which in the House of Commons. The following Bills were allocated to the House of Lords:—Bournemouth Corporation; Buenos Ayres Grand National Tramways; Bury Corporation; County of Durham Electric Power Supply (Further Powers); Crediton Lighting and Power; Cumberland Electricity and Power Gas; Folkestone and District Electricity Supply; Folkestone, Sandgate and Hythe Tramways (Nos. 1 and 2); Haslingden Corporation; Huddersfield Corporation; Kent Collieries; Kent Electric Power; Mersey Railway; Newcastle-upon-Tyne Electric Supply (Additional Powers); Nottinghamshire and Derbyshire Tramways; Oxford Corporation; Riston, Chorley and Horwich Tramways; Shropshire, Worcestershire and Staffordshire Electric Power; South Lancashire Tramways (Extension of Time); Southport and Lytham Tramroad; Wallasey Tramways and Improvements; West Cumberland Electric Tramways; West Yorkshire Tramways.

Among the Bills originating in the House of Commons will be the following: Additional Electric Power Supply (London); Administrative County of London and District Electric Power; Baker Street and Waterloo Railway; Brixham Gas (Electric Lighting); Carlisle Corporation; Charing Cross, West End, and City Electricity Supply (Power Supply); City of London Electric Lighting; Corporation of London (Blackfriars and other Bridges); Cork City Railway and Works; Cork Link Railways; Derbyshire and Nottinghamshire Electric Power; Hackney Electricity; Hammersmith, City, and N.E. London Railway; Huddersfield Corporation; Kingston-upon-Hull Corporation; Lancashire Electric Power; London and Brighton Motor Way; L.C.C. (Electric Supply); L.C.C. (General Powers); L.C.C. (Tramways and Improvements); London Electric Supply Corporation; London Outer Circle Railway; London and South-Western Railway; London Southern Tramways; London United Tramways; Macclesfield and District Tramways; Manchester Corporation; Metropolitan District Railway; Metropolitan Electric Supply; Metropolitan Pneumatic Despatch; Metropolitan Railway; Middlesex County Council (Tramways); North-East London Railway; North Metropolitan Tramways; North and South Shields Electric Railway; North-West London Railway; Oldham and Saddleworth District Tramways (Abandonment); Romford and District Tramways; St. Pancras Electricity; Shoreditch and Stepney Electricity; South Metropolitan Electric Light and Power; South Wales Electrical Power Distribution Co.; Surbiton Improvement; Todmorden Corporation; Twickenham and Teddington Electric Supply; Watford and Edgware Railway; West London Electric Undertakers' Association.

Trade Announcements.—Messrs. T. and E. Wannbacher, of 28A, Basinghall Street, E.C., are representing in this country the Armaturen und Maschinenfabrik, A.G. Pegnitz, makers of sluice valves and valves for all purposes. In a list recently issued they give views of large valves that they have supplied.

Messrs. Marples, Leach & Co., 6, Victoria Avenue, Bishopsgate Street Without, E.C., have purchased the business which was formerly carried on under the name of the "Adnil Electric Co." at that address, and they have been appointed sole agents for the Bergmann Electrical Works, Berlin, for the whole of their manufactures, which comprise all types of A.C. and D.C. dynamos and motors, controllers, switches, conduit, holders, fittings, and lamps.

The name of the firm of F. Gabriel & H. Angenault has been altered to the Gabriel Lamp Co. (15, Victoria Street, S.W.) from January 22nd.

The Rhodes Electrical Manufacturing Co., Ltd., ask us to state that Mr. P. A. Paris has severed his connection with them and no longer represents them in the Manchester district. All communications for the time being should be addressed to the head office at Bradford.

Brush Contracts.—The following contracts have just been secured by the Brush Co.:—

For Liverpool Parish.—Three 85-kw. steam dynamos for Workhouse installation.

For Bermondsey Electricity Works.—500-kw. steam dynamo.

Morley Electrical Exhibition.—Mr. J. E. Ellis, the borough electrical engineer, informs us that his Committee has decided to hold an exhibition of electrical appliances, &c., in the town on April 5th, 6th and 7th next. Electricity supply charges are low, and there are a large number of mills and works within the borough boundary. This exhibition should result in the further adoption of electric power for driving purposes. Firms desirous of exhibiting should apply to Mr. Ellis for a copy of a pamphlet he has issued.

Football Match.—On Saturday last a match was played between the Western Electric Casuals Football Club and Messrs. W. T. Henley's Staff, at North Woolwich. After about 10 minutes' play, the Western Electric opened the scoring by a fine shot from their centre forward. This seemed to put Henley's men on their mettle, and after a few minutes they equalised. The game then became very exciting, and just before half-time arrived the Casuals again scored. On resuming, Henley's at once got down the field and looked dangerous, but the defence was impregnable. After a lot of mid-field play, the Westerners again took up the attack, and from a free kick scored their third goal, running out winners by 3 goals to 1.

Admiralty Contract.—The Lords Commissioners of the Admiralty have just placed with the British Thomson-Houston Co., Ltd., of Rugby, an order for a large capacity continuous current type MP motor and electrically operated switchgear to operate a set of hydraulic pumps of the horizontal type capable of supplying a total quantity of 180 gallons of water per minute at a pressure of 650 lb. per sq. in. to a hydraulic accumulator. The motor will be compound wound, and is to be started and stopped automatically by the rise and fall of the hydraulic accumulator.

Private Telephones.—The Electrical Engineering and Maintenance Co., of London, E.C., have recently carried out a complete telephone installation for the Sutton District Water Co., which includes overhead wires between the various outbuildings.

Dejecoline Boiler Fluid.—The British Boiler Fluid and Engineers' Stores Co., Ltd., of Limehouse, E., have been awarded the contract for supplying the British Admiralty with their "Dejecoline" boiler fluid for the current year.

Catalogues.—Messrs. Marples, Leach & Co., London.—Set of the firm's leading catalogues in a convenient binder, allowing for the filing of additional lists as these are issued. These circulars are devoted to very full particulars arranged in detailed tabular form of two and three-phase induction motors, direct-current dynamos and motors, single, two and three-phase generators, electric fans, knife switches, cut-outs, fuse plugs, and a large variety of electrical accessories.

The British Thomson-Houston Co., Ltd., Rugby.—New pamphlet giving a full illustrated description of their automatic circuit-breakers, particularly the new C type with carbon contacts; the latter, it is claimed, can be used with advantage in many instances where fuses and switches would otherwise be installed, because they combine the protection of the fuse with the convenience of the switch. The M R and M Q circuit-breakers, which have been on the market for some time, are also included in the pamphlet, so that all the company's designs of circuit-breakers could be brought together in one publication.

Mr. N. Gunz, 46, Queen Victoria Street, E.C.—Leaflet enumerating the various lines of electrical and other materials and supplies for which he now represents a number of manufacturers and producers.

MESSRS. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.—Price list (No. 10) illustrating standard lines of their distributing boards, tumbler, Acme and knife switch, switch fuse and Mordey fuse distribution boards, also porcelain bridge and other fuse boards; prices are given in tabulated form at the bottom of each page.

The CRYPTO ELECTRICAL CO., 3, Tyers Gateway, Bermondsey Street, E.C.—Catalogue of numerous specialities, including the Crypto dynamo bicycle driving gear, carbon brushes, small motors, dynamos, alternators, transformers, battery-charging switchboard, castings and material for dynamo construction, measuring instruments and portable hand drills.

MESSRS. SIMMONDS BROS., Newton Street, High Holborn, W.C. Sixteen-page pamphlet giving full particulars with illustrations of their Niphon couplings for electric cables, and movable armoured installations for temporary wiring work of all kinds.

KYNOCH, LTD., Lion Works, Witton, Birmingham.—Several large cards relating to their suction gas plants and their economy compared to town-made gas supply.

MESSRS. BAGSHAWE & Co., 3, Tower Royal, Cannon Street, E.C.—Illustrated price lists of "B.B." wood split pulleys and of leather machine belting.

THE ROBURINE CO., 15, Victoria Street, S.W.—Catalogue of Roburine insulating material for electrical work (roburine, mineralite, ebonite, gummite, infusite, &c.); also a price list of black roburine handles.

MESSRS. WM. WADSWORTH & SONS, School Hill, Bolton.—Booklet No. 6 relating to hoists, including self-landing and delivering hoists, cage hoist and steel hoist well, mill hoists, electric lift gear, and small "Handy" hoists.

The TITAN PACKING CO., 2 and 3, Tower Royal, Cannon Street, E.C.—Circular of Titan packings.

MESSRS. S. WOLF & Co., 138, Southwark Street, S.E.—Illustrated pamphlet (16 pp.) describing portable electric drilling machines. Among the various types shown are a line of Feather-weight electric hand drills and electric sensitive drilling machines with movable or fixed tables.

The A.E.G. MANUFACTURING CO., LTD., 4-5, New Compton Street, W.C.—Sixteen page illustrated list of Nernst electric lamps with lanterns for outdoor use, such as shop window and street lighting. The "Multiple" type is said to be effectively replacing arc lamps.

MESSRS. FERRANTI, LTD., Hollinwood.—Catalogue No. 64 relating to triple-pole, single-throw, slow-break knife switches.

Bankruptcy Proceedings. — EDWARD MANN. — A sitting of the London Bankruptcy Court was held on January 19th before Mr. Registrar Brougham, for the public examination of Edward Mann, electrical engineer, 9, Bridge Street, Westminster, who applied to pass upon accounts showing liabilities £9,189 and assets nil. In the course of his evidence the debtor stated that from June, 1898, to May, 1899, he carried on business at the above address as an electrical engineer. In the latter month he converted the business into a limited company, registered as the Compass Trading Co., with a nominal capital of £5,000. As vendor he received £1,000 in cash and shares, and was appointed managing director at a salary of £500 a year. The business went on until the middle of 1904, when the debenture-holders took possession. The trading had not been sufficiently successful to enable his salary to be paid in full after the first year. Witness attributed his failure partly to ill-health, which prevented him from properly attending to business. It was, in fact, in consequence of his absence that possession was taken by the debenture-holders. A large amount of capital was sunk at the Crystal Palace in the Fairy Archipelago, and his liabilities were entirely for guarantees he had given for the payment of the company's debts. Since 1899 witness had also been engaged as secretary and manager of various companies, included in the number being New & Mayne, Ltd., the Sydenham Water Chute, Ltd., the Zamal Syndicate, Ltd., the Electric Trust, Ltd., and the Woking Electric Supply Co., Ltd.

ALFRED SUTTON.—The first meeting of creditors was held last week before Mr. E. S. Grey, Official Receiver at the London Bankruptcy Court, of Alfred Sutton, dealer in electric fittings and fancy goods. The director carried on business under the style of "Suttons" and "Sutton Bros.," at 329, Kennington Road, and 17 and 18, York Terrace, Clapham. He was also interested in the Fairy Archipelago at the Crystal Palace, and in addition, traded there as a tobacco dealer. It appeared from the debtor's statements that the business at Kennington was an old established one, and had been carried on by him since the death of his father, 11 years ago. He put in no fresh capital, but paid off the existing liabilities, which amounted to about £170. He also agreed to pay his brothers and sisters £200 for their share in the business, but has not been in a position to pay them anything, and has only drawn £2 10s. weekly from the business for his own expenses. Business has been carried on at York Terrace only since 1902, and generally to a loss, to which, combined with trade depression, the failure is ascribed. The accounts filed by the debtor, show unsecured debts, £590 6s. 9d.; liabilities on accommodation bills. £38 15s.; preferential claims for rent, £201 1s. 7d.; and assets, £152 5s. 6d. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up for bankruptcy, the debtor's public examination being fixed for February 6th.

A. R. KRAUSE.—A receiving order was made on debtor's own petition on January 15th, at Manchester, against August Richard Krause (Ashcroft and Co., Victoria Buildings, Manchester), electrical inspector, formerly an electrical engineer. The first meeting is to be held on January 31st, and the public examination on February 5th at Manchester.

WALTER BINNS.—Last week Walter Binns, of Stanhope House, Frizinghall, came up for examination. Bankrupt said, according to the *Manchester Daily Guardian* report, that in 1902 he was concerned, along with two other persons, in the promotion of a Bill in Parliament conferring powers upon himself and his nominees to construct tramways in Mexborough, Swinton and Rawmarsh. He also took over certain electric lighting orders. The Bill was promoted by him at his own cost, but he found himself unable to proceed for want of funds. He agreed with the New General Traction Co. that they should carry out the work, and pay him £10,000 in cash and £10,000 in shares of the company they proposed to form, but for some reason that agreement was never carried out. About September, 1904, he was introduced to a Mr. G. C. Isaacs, a London company promoter, who agreed to promote a company to carry out the work and pay him £15,000 in cash and £10,000 in fully-paid shares of the company. The attempt to form a new company failed, and Isaacs then obtained a power of attorney from the debtor, which gave him absolute power to deal with the various district councils and to approach the National Electric Construction Co. in order to get them to construct and equip the lines. Mr. Isaacs agreed with them that the company should pay £12,000 in cash and £11,000 in shares, with which he was to pay about £10,000 liabilities, the balance to be handed to the bankrupt. At present the tramways were more than three parts completed, and he was told that Mr. Isaacs had received £10,000 cash and £7,500 shares. He had been unable to get any account from Mr. Isaacs, who was indebted to him to the extent of £12,675, which, he contended, would leave him a surplus of £3,480. The examination was closed.

Mexico.—The WESTINGHOUSE ELECTRIC AND MANUFACTURING Co. has secured orders for 50 alternating current induction motors for the Guanajuato Power and Electric Co. The motors will be installed at the mines of the Peregrina Mining and Milling Co., to work their new 120-stamp mill, and also at the 60-stamp mill of the San Prospero Mining and Milling Co. These motors have a capacity of about 1,500 H.P. The Westinghouse Co. already have motors of over 8,000 H.P. capacity in similar service in the El Oro district on the Necaxa circuits. Besides the above several Westinghouse motors and Byron Jackson pumps have been sold to the Lake Chapala Investment and Improvement Co., and will be used for irrigating purposes.

For Sale.—Particulars appear in our advertisement pages to-day of two auction sales to be conducted by MESSRS. WHEATLEY KIRK, PRICE & Co.; one on February 6th of incandescent lamp renovating plant and stock at Britannia Street, City Road, N., and the other on January 31st of about 4,500 second-hand electricity meters at Marylebone.

Dissolutions and Liquidations.—The THUNDERBOLT PATENT GOVERNOR CO., LTD.—A meeting is to be held at Royal Exchange, Middlesbrough, on February 20th, to hear an account of the winding up from the liquidator (Mr. G. B. Nancarrow).

E. CALDWELL & SON, electrical engineers and bell-hangers, 27, South Sherwood Street, Nottingham. Messrs. Jane Caldwell and W. Caldwell have dissolved partnership.

Annual Dinners.—On Saturday last the staff and employés of MESSRS. RAWLINGS BROS., LTD., held their annual dinner at the Horseshoe Hotel, Tottenham Court Road. About 100 were present, Mr. J. J. Rawlings, one of the managing directors, being in the chair. After dinner, a musical programme, interspersed with toasts, was proceeded with. The loyal toast having been honoured, Mr. T. S. Rowden proposed "The Firm and Directors." Mr. W. R. Rawlings rose in response, and referred to the fact that, owing to their having so many large jobs on hand in the country and in Ireland, their number that evening had suffered very much in consequence; but this was a penalty of prosperity. The chairman next gave the toast of "The Employés," and remarked that, like a spring, a working staff must be well-tempered and flexible, ready at all times to put forth its energies, but, at the same time, it could be strained or broken if too much were demanded from it. He wished to impress upon the younger members the importance of availing themselves of the splendid advantages now offered to them to improve their technical and theoretical knowledge, advantages which had been denied the earlier generations. He instanced many cases of misdirected energy which might have been avoided if the workman had had a better knowledge of the technique of his trade. Mr. E. G. Nicholson next proposed the toast of "Our Professional Friends," which was responded to by Mr. J. H. Wiggington (of Messrs. Taylor, Lovegrove & Co.) and Mr. R. T. Smith, the chairman of the company. "The Visitors" was proposed by Mr. G. W. Rogers, Mr. E. Anderson responding.

The second annual staff dinner of the ANCHOR CABLE CO., LTD., Leigh, Lancs, took place on Thursday, January 11th, at the Courts Hotel, Leigh, Mr. R. H. Harvey (manager) occupying the chair. Songs were rendered by the members of the staff, and a very enjoyable evening was spent.

Last Saturday evening over 150 employés of the UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON dined together in the Leopold Rooms, Ealing, W., under the presidency of the superintendent of the Mill Hill Park Car-Sheds (Mr. G. G. Porter).

On Monday and Tuesday nights the employés of the Hull Corporation tramways department had their annual tea and dance.

The Norwich Electric Tramway Co.'s employés have just been entertained to their annual dinner by the directors.

Roller Bearings.—The EMPIRE ROLLER BEARINGS Co., of Westminster, has secured an order for 320 axle-boxes to be fitted to 80 heavy goods wagons for Calcutta.

American Electrical Exports.—The value of the electrical appliances exported from the United States during November last is returned at £109,371, as compared with only £91,895 in the corresponding month of 1904. On the other hand, the exports of electrical machinery declined from £145,971 in November, 1904, to only £109,547 in the same month of last year.

Arc Lamp Lowering Gear.—The London Electric Firm, of Croydon, have just received an order from Messrs. Foote and Milne, Ltd., for about 200 complete sets of their "One Working Part" arc lamp lowering gear for Malta Dockyard, the consulting engineers being Messrs. Preece & Cardew.

Book Notices.—*Bulletin of the Bureau of Standards.* Edited by S. W. Stratton, Director of the Department of Commerce and Labour, U.S.A. Washington: Government Printing Office.—These bulletins embody the results of the investigations, researches, and other work of the Bureau, and are issued at intervals depending upon the number of papers ready for publication; they resemble the "Collected Researches" of our National Physical Laboratory, covering a variety of subjects connected with physics. No. 1, issued in November, 1904, contained, amongst other matters, a Study of the Silver Voltameter, by K. E. Guthe; an article on the So-called International Electrical Units, by F. A. Wolff; Some New Rectifying Effects in Conducting Gases, by P. G. Nutting; and an article on the Temperature of the Arc, by C. W. Waidner and G. K. Burgess. No. 2 contained articles on the Absolute Measurement of Inductance and Capacity, by E. B. Rosa and F. W. Grover; and No. 3, issued in November last, included further articles on the Measurement and Standards of Inductance, by the last-named authors; the Silver Coulometer, by K. E. Guthe; Wattmeter Methods of Measuring Power, by E. B. Rosa; Influence of Wave Form on the Rate of Integrating Induction Wattmeters, by E. B. Rosa, M. G. Lloyd and C. E. Reid; Detector for Small Alternating Currents and Electrical Waves, and the Positive Charges Carried by the Canal Rays, by L. W. Austin; and a Five-Thousand Volt-Generator Set, by P. G. Nutting. We need not enlarge upon the value of a publication of this description, which will be obvious to those of our readers who are interested in physical science; some of the papers are also of immediate interest to station engineers and manufacturers.

Lockwood's Builders' and Contractors' Price Book. 1906. Edited by F. T. W. Miller. London: Crosby Lockwood & Son. Price 4s.—This familiar price book has been revised and amplified, and the section dealing with electric lighting has been carefully edited by Mr. A. P. Haslam. The price lists given include the products of several manufacturers, and relate mainly to British firms. Particulars are given of the approximate cost of wiring houses of various sizes, and of the cost of running and maintenance, and the wiring rules of the City of London Electric Lighting Co. are reproduced in full. Information regarding bell and telephone installations is also given. As an approximate guide to costs, the work is certainly to be recommended, and it contains a vast amount of general information in connection with the building trades.

The Writers' and Artists' Year-Book. 1906. London: Adam and Charles Black, Soho Square. 1s. net.—This is an interesting and useful book for writers, artists and photographers, who wish to know something about periodicals before submitting contributions or specimens of their work to them.

Mica: Its Occurrence, Exploitation and Uses. By Fritz Cirkel, M.E. Ottawa, Canada: Mines Branch Department of the Interior. 1905.—This report is the first of a series of publications to be issued by the Mines Branch on the Economic Minerals of Canada, and deals with the whole subject of the properties, distribution, mining and utilisation of mica in an exceedingly thorough and detailed manner. A map is given of the Mica Region, which produces nearly 1½ million lb. per annum; the bulk of the output used to go to the United States, but Canadian mica has gained a footing in the British market in recent years, and we now take about one-half of the production. Particulars are given of the various mines, some of which are owned by the General Electric Co. A chapter is devoted to the commercial applications of the mineral, amongst which electrical apparatus manufacture bulks largely; in fact, the development of the mica industry is attributed to the electrical demand, the Canadian amber mica being highly esteemed for this purpose. The use of scrap mica for boiler coverings, and for heat-insulating steam pipes, &c., is especially dwelt upon; numerous experiments are quoted, showing that mica covering saves about 90 per cent. of heat, as compared with a bare boiler or pipe. As scrap mica, formerly of little use, is available in large quantities, and is cheap, it is obviously ideally adapted for this purpose.

Practical Dynamo and Motor Construction. By Alfred W. Marshall. Messrs. Percival Marshall & Co. Price 1s.—This little book of 125 pages is written for the class of amateurs whose chief ambition in life is to build a small dynamo or motor. Here they will obtain a great variety of practical wrinkles concerning those types of machines so familiar to us, and to be seen in the windows of model-making establishments. There are chapters on the winding of field magnets, drum and ring armatures, shuttle-wound armatures, commutators, and brush gears. The author has had a great deal of experience in this class of work, and his book deals entirely with workshop difficulties. The illustrations are excellent, and very numerous, and we consider the author has succeeded in producing a book which contains quite a wonderful lot of information of great value to model engineering people.

Annuaire pour l'An 1906. Paris: Gauthier-Villars. Price 1 fr. 50 c.—This little volume contains, as usual, a vast number of data useful to engineers and scientists. A special feature of the present issue is an article on "The Eclipses of the Sun," by M. G. Bigourdan, giving brief particulars of the observations that can be made during their progress, and summaries of the results obtained in the eclipse of August 30th last year.

Internationaler Telegraphisten-Kalender (International Handbook for Telegraphists) for 1906. Gartz a. d. Oder: Karl Fiebelkorn.—A copy of this handbook has just reached us, and the authors—G. Evans and Otto Cantzler, Cologne—at the end of the book ask indulgence for its late appearance, and give assurance that future issues will appear on October 1st every year. The authors announced the appearance of this little volume in a circular issued about July last, which explained that they were induced by numerous interested parties to publish it. Both gentlemen are, it appears, officials of the Deutsch-Atlantische Telegraphengesellschaft. The title of the book, we think, is not well chosen, it being more in the nature of a diary than a handbook, for out of 323 pages, 202 form the diary. Other 29 pages are devoted to a list of cable and telegraph companies, and particulars of their cables and chief officials. The book has been carelessly compiled, and it is full of errors from one end to the other. Information has been taken from the International Convention and reproduced in this book, followed by a "Vocabulary of the most Commonly used Forms for Service Telegrams," "Training of Telegraphists," and "Recent Advances in Telegraphy." We do not know that the book supplies any want at all. It practically contains only matter which can be found in other publications, at very little greater cost, and giving much more extended information. The diary does not compare, as a diary, with many others published at a much lower price.

"Mathiesons' Highest and Lowest Prices"; "Mathiesons' Provincial Highest and Lowest," at 2s. 6d. each; "Monthly Mining Handbook," 1s.; "American Traffic Tables," "Half-Yearly Traffic Tables," at 6d. each.—Here we have a batch of publications which are practically indispensable to investors who want to be guided in purchases of stocks and shares by the past market records of the various undertakings. Messrs. F. C. Mathieson & Sons, of 16, Copthall Avenue, E.C., are the publishers.

"Engineering Press Monthly Index Review." Vol. VII., No. 3. December, 1905. Brussels: Association de la Press Technique. 2.50 fr.

"Whittaker's Electrical Engineer's Pocket-Book." Edited by Kenelm Edgcumbe. London: Whittaker & Co. 3s. 6d. net.

"Management of Accumulators." By Sir D. Salomons. Ninth edition. London: Whittaker & Co. 6s. net.

"The Energy Chart: Practical Applications to Reciprocating Steam Engines." By Capt. H. R. Sankey, R.E. Rugby: Albert Frost & Sons. 10s. 6d. net.

"Steam Turbines: Their Development, Styles of Build, Construction and Uses." By W. Gentsch. Translated by A. R. Liddell. London: Longmans, Green & Co. 21s. net.

"Guide to Income and Property-Tax Assessment and Recovery." By H. Theobald. London: Pioneer Press. 1905. Price 3s. 6d.

Sentences.—At the Clerkenwell Sessions last week, John Sayer pleaded guilty to obtaining £5 5s. by fraud from Mr. Duncan Watson, an electrical engineer, under circumstances already reported. He was sentenced to six months' imprisonment in the second division.

When sent to do certain electric lighting work at the residence of Mr. Justice Walton, at Montagu Square, W., Donald Duncan, 21, "an electrician," stole some electric light fittings and a pair of the butler's trousers. He was sentenced at Marylebone to six months' imprisonment.

Calendars and Diaries.—Messrs. Johnson and Phillips have issued a desk calendar for this year. On each monthly card there appears an illustration of work on a cable contract which has been carried out by them during last year.

We have been favoured with a neat glass paper-weight bearing the compliments of the British Accumulator Co., Ltd., of Westminster.

Messrs. Jackson Bros., of Broadway, Plaistow, E., have sent us a hanging calendar for 1906 with monthly sheets.

The Allgemeine Electricitats Gesellschaft have hit upon a novel idea for keeping their name before their friends during this year—indeed, it will serve for all time. A model motor-generator serves the purpose of a calendar of the perpetual form, the dates appearing on the left-hand machine, and the months on the right-hand one, on cylinders which can be rotated at the user's pleasure.

Messrs. C. Straker & Sons, printers, have sent us one of their hanging mercantile annuals for 1906; also a wall calendar with monthly slips. The latter differs from all calendars received this year in that it has at bottom a pocket wherein a number of "post-cards for orders" are placed.

LIGHTING AND POWER NOTES.

Ashton-in-Makerfield.—The U.D.C. has decided to circularise the ratepayers to ask if they will take a supply of electricity provided it is charged for at the same rate as at Wigan. The Council's E.L. order has not long to run, and there is no prospect of its renewal.

Australia.—Broken Hill, N.S.W.—The local council has purchased the electricity works of Messrs. Strachan & Mars for £12,000.

Aylesbury.—The U.D.C. has given its consent to the application of the Mutual Electricity Supply Co. for an E.L. prov. order for the district.

Beckenham.—Pending the completion of the extension of the Council's electricity works, the B.E.T. Co. has arranged with the Croydon Corporation for a temporary supply of energy to commence in a few weeks, and continue until April next. In reply to a L.C.C. invitation to support the Electricity Supply Bill, the Council states that it is opposed to the County Council obtaining any powers for the supply of electrical energy.

Blackpool.—On the 18th inst. a L.G.B. inquiry was held into the application by the Corporation for sanction to various loans, included in which was one for £4,000 for E.L. purposes.

Blackrock (Dublin).—The U.D.C. has notified that it is prepared to accept an offer for its E.L. prov. order. The sum of £300 is suggested; the original cost to the Council was £150. Other municipalities might indulge in a little speculation of this kind; 100 per cent. profits are above the average.

Bradford.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £60,000 for E.L. purposes. Of this, £37,509 is for mains and network extensions now necessary, and £22,491 for similar purposes when needed. Mr. C. J. Casse, as a ratepayer, asked, on behalf of the Electrical Contractors' Association, if any portion of the loan was to be used in any kind of municipal trading, which might in any way interfere with the business of contractors in the city. The Government inspector replied that the electrical engineer in his evidence would state for what purposes the money was required, and nothing further transpired.

Brandon.—The U.D.C. has adjourned for two months the question of providing electricity works in connection with the proposed refuse destructor, with the object of ascertaining the views of the ratepayers on the matter.

Brighton.—The town clerk has been served with a writ claiming damages for nuisance from the electricity works, North Road, and an injunction.

Canada.—A Montreal paper states that the Southern Light and Power Co., which was erecting extensive works at Erindale, is insolvent, and that the company owes a loan of $15,000, and $12,000 on wages account.

Chichester.—Negotiations are being conducted in regard to the transfer of the E.L. prov. order to a company.

Continental Notes.—FRANCE.—E.L. plants are now being erected at Airvault (Deux Sèvres) and Cheny (Yonne) for the lighting of the districts.

The Société Electrique du Roannais has obtained the concession of the electric lighting of Montagny (Loire).

A concession has been granted for the electric lighting of Periers (Manche).

The Entreprise Electrique de la Bèze has obtained powers to light Heuilley-sur-Saône by electricity.

The Gap (Haute-Alpes) T.C. has approved of the report of the committee appointed with a view to substituting electricity for gas in the electric lighting of the town.

Messrs. Lemarchand & Vigeron, of Paris, have secured E.L. powers for lighting the towns of Barenton, La Coulonche and St. Andre-de-Messei (Orne).

The Société Grenobloise Fures et Morges has commenced operations at the junction of the Bonne and Roizonne Rivers; with a view to constructing an electric power plant of 2,000 H.P. The total cost is estimated at 62,000,000 fr.

Work is at present under way for transmitting electric power to work the tramways of Lyons by current supplied from the plant of the Compagnie "La Volta," at Tarentaise. The power to be transmitted is estimated at 5,400 H.P., and the cost of the line will probably be nearly 5,000,000 fr.

The construction of an electricity works at Brest is contemplated, and a correspondent states that the plant will comprise 12 Niclausse boilers and five turbo-alternators of 750-KW. each, to generate three-phase current at 5,000 volts.

ROUMANIA.—Permission has been sought, says the *Board of Trade Journal*, for the lighting of the town of Focsani by electricity, the estimated cost being 13,920 lr.

SPAIN.—An electricity works will shortly be inaugurated at Lagunas de Ruidera to supply electrical energy to La Solana, Membrilla, Manzanares, Alhambra and Valdepenas.

GERMANY.—Tenders are to be invited for the establishment of a municipal electricity works at Dornham, Wurtemburg.

ITALY.—Application has been made for a concession to erect a plant on the River Codero (Sondrio) to supply electrical energy for lighting and power purposes.

Compton.—It was reported to the U.D.C. on January 17th that the B. of T. had extended the E.L. order until January 2nd, 1907, but had intimated that it would not extend it beyond that date.

Dundee.—The Caledon Shipbuilding Co. has decided to install electrical plant in its shipyard, but as it is desirable to run some machines continuously day and night, the Co. has asked the Corporation whether it would be prepared to supply the yard with electricity from 9 p.m. to 6 a.m. The matter has been postponed for further consideration by the Electricity Committee. The burgh electrical engineer does not recommend a stand-by supply as desired by the company.

The Electricity Committee has considered the report of its electrical engineer upon the question of future supply, and decided to recommend to the T.C. that the existing generating station could not be extended with economy; a sub-committee to deal with the question of a site for a separate undertaking has been appointed.

Earls Barton.—The P.C. has decided to give its sanction to the Bill of the County of Northampton Electrical Power and Traction Co.

Erith.—The U.D.C. has decided to take up a loan of £15,000 at 3⅞ per cent. interest, on account of the sum of £19,878 sanctioned by the L.G.B. in March last.

The U.D.C. has reduced the charge for arc lamps from £25 to £20 each per annum.

Glasgow.—The Electricity Committee has recommended that where a supply of electricity for power purposes of 500,000 units or more per annum, with not less than 2,000 hours' use per annum, is given, the charge should be ¾d. per unit.

Grangemouth.—Mr. H. B. Maxwell, burgh electrical engineer of Partick, has been retained by the T.C. to report on electricity supply in the burgh. The points to be reported on are as to which of the following alternatives should be adopted:—(1) The utilisation of water power, three miles from the town; (2) the installation of a station in the town; (3) the erection of a destructor; (4) taking a supply in bulk from the Scottish Central E.P. Co.; (5) any combination of the above, or (6) the transferring of the order to the Scottish Central or other company with power to purchase. It is not at all surprising that the T.C. needs advice.

Handsworth.—The U.D.C. has unanimously decided to oppose the Shropshire, Worcestershire, and Staffordshire E.P. Bill.

India.—LUCKNOW.—The Lieut.-Governor of the United Provinces has, says *Indian Engineering*, granted to the British Eastern Electric Power Co. licences to supply electrical energy for public, private and traction purposes within the area of the Municipal Board's jurisdiction.

Liverpool.—Another protest has been made against the municipal hiring out of motors, this time at Liverpool. It is contended that there is no demand in the city for the hire-purchase of electric motors, and that should any such demand arise the local contracting firms are quite prepared to meet it.

London.—HACKNEY.—It has been decided by the Committees of the Council to revise the public lighting rates as from April 1st next, as follows:—10-ampere lamps from £18, and 7-ampere lamps from £15 16s., to £13 10s., and £11 respectively; these rates exclude interest charges, &c., estimated at from £2 to £2 10s. per lamp per annum. Street lighting is to become a direct charge on the general account of the Council.

SOUTHWARK.—In reference to the B.C. accounts, the district auditor has agreed to an objection raised on the profit and loss account of the electricity undertaking. No central establishment charges were placed against revenue. It has been agreed to set aside £100 per annum to cover this.

WESTMINSTER.—The Law and Parliamentary Committee of the C.C. are anxious to petition against the L.C.C. Power Bill; they point out that the County Council's own Finance Committee are against the scheme.

Rawtenstall.—The T.C. has decided to oppose the Bill of the Lancashire Electric Power Co.

South Africa.—VRYHEID (NATAL).—A concession has been granted to Messrs. Reynolds, Tait & Stevenson, of Durban and Vryheid, for the supply of electric light and power in the township. The Silvertown Co. are the contractors for the complete scheme—including power station—which is being carried out in accordance with designs by Mr. H. B. Whitmee, the company's resident engineer in South Africa.

CAPE TOWN.—A large installation has recently been put down at the Adderley Street premises of Messrs. Stuttaford & Co. by Messrs. Koch & Dixie, of Cape Town. The installation, which is carried out in insulated steel conduit, comprises main switchboard and distribution board, 42 arc lamps, 570 incandescent lamps, two 9-H.P. motors, and two ½-H.P. motors. In all about ten miles of wire and 16,000 ft. of conduit was used on the work.

South America.—CHILI.—The *Board of Trade Journal* states that the Compania General de Electricidad has been granted a concession for supplying La Cruz (Quillota) with electric lighting and power.

South Stoneham.—The B. of G. has deferred the question of installing E.L. plant at the workhouse for six months. The estimated initial outlay is £1,450, and the annual cost £249. At present gas costs £245 per annum.

Upholland.—In regard to an application of the U.D.C. to the Lancashire Electric Power Co. in reference to a supply of energy to the district, the company has replied that it will not be in a position to supply until the Spring of 1907, and that it would be necessary for the Council to obtain a prov. order and lay four miles of mains at a cost of about £5,500. The Council is also negotiating with Wigan T.C.

U.S.A.—NIAGARA FALLS.—According to the *Daily Telegraph*, the New York State Assembly intends to ask the President to make a treaty with Great Britain for the preservation of the Falls, this, it is contended, being necessary owing to the continued demands of the power companies.

Walthamstow.—The sanction of the L.G.B. is to be obtained for the borrowing of £500, the estimated cost of heating the generating station. Complaints of nuisance having been made against the station, the consulting engineer is to submit a report and estimate of the cost of dealing with it. The Committee has instructed the electrical engineer to submit detailed alternative schemes for supplying electricity to Highams Park.

Waterford.—The Corporation has decided to petition against the application of the National Provincial Electricity Corporation for powers.

Weardale.—The U.D.C. has decided to invite an engineering firm to prepare plans and estimates for an E.L. scheme.

Willesden.—Sanction has been received by the U.D.C. to the borrowing of the following amounts for electricity purposes:—Mains, £13,678; services, £1,382; plant and lamps, £3,500; meters and indicators, £1,440.

Windsor.—By four votes to three the R.D.C. has decided to consent to the application of Messrs. Foote & Milne for a prov. order for E.L. for the parishes of Sunninghill and Sunningdale.

TRAMWAY AND RAILWAY NOTES.

Ashton-in-Makerfield.—The B. of T. has forwarded to the U.D.C. sanction to raise a loan of £22,170 for the purchase of so much of the Wigan tramways as is in the Council's district.

Australia.—Victoria.—A conference of representatives of the Hawthorne, Malvern and Kew Councils was held recently to discuss the proposal to establish an electric tramway to the beach at St. Kilda. It was agreed to recommend the Councils interested to approve of the scheme.

Brooklyn.—Another train left the rails on the elevated railway on Friday last, and one carriage crashed into the street below, a distance of 40 ft. Two men were killed, and a dozen persons were injured, two, it is believed, fatally. The accident was attributed to a misplaced point, which was apparently left open by mistake. The first carriage got across the point, but the second fell into the street; the third carriage also left the rails, and narrowly escaped the fate of the middle carriage.

Canada.—The Grand Trunk Railway System announces that arrangements have been made for the adoption of electric traction in the St. Clair Tunnel. The contract has been awarded to the Westinghouse Electric and Manufacturing Co.; work is to be started at once and brought to completion as quickly as possible. The system to be adopted is alternating single-phase current with overhead conductors. The conductors in the interior of the tunnel will be fixed upon the walls, and in the railway yards will be supported by steel bridges. The trains will be drawn by locomotives capable of hauling a passenger train at the rate of 20 to 25 miles an hour, and a freight train of 1,000 tons at the rate of 10 miles an hour. The interior of the tunnel and the yards on both the United States and Canada sides of the St. Clair River will be lighted with electricity. The power will be developed by steam turbines.

According to an American contemporary a move of importance in connection with the motive department of the Canadian Pacific Railway is the decision of the management to take up actively the idea of using electricity as motive power. For some time past officials of the electrical department have been working on the matter, and have investigated the experiences of other railways in this connection. It is understood that electricity will first be installed on some of the branch lines in the province of Quebec.

Continental Notes.—Italy.—Recent statistics give the track length of the Milan tramways at 70 miles, of which the minimum curve has a radius of 60 ft., the number of passengers carried exceeds 81,000,000 per annum. Near the centre of the city the headway on the tracks common to several main routes, during the holidays, is frequently as short as 26 seconds and on other days 80 seconds, the actual distance between succeeding cars being about 40 yards. Single lines are not laid in any street with a less width than 18 ft., nor double lines where there is less than about 25 ft., in both cases excluding the foot ways. The cars have to stop anywhere on demand; the system of fixed stopping-places was tried experimentally on one route, but abandoned because it did not comply with public requirements. The number of accidents to the general public in 1903 numbered 310, of which 4 proved fatal. With a very similar length of route on the Naples tramways the number of injuries was 322 and of fatal cases 13. In each city by far the largest number of accidents occurred through falls; this is in some measure accounted for by the large number of standing passengers who are allowed to crowd on to both the front and back platforms.

Our contemporary *L'Elettricita*, of Milan, is informed that the company for the navigation of the Lake Maggiore in conjunction with the Credit Italian Bank has asked the Government for a concession to construct and work an electrical funicular railway between Stresa and the summit of Mottarone.

Plans are being prepared in respect of a projected electric tramway between Val di Taro and Birio Bixio (Parma) and also one between the latter place and Val Buganza.

Spain.—The Société Anonyme des Tranvias de Malaga has obtained a concession for an electric tramway from the Paseo de Reding to La Malagneta.

The Société des Tranvias de Zaragoza has obtained a concession for an electric tramway from Torrero to La Cimitière.

Elland.—Provided street widenings are carried out and energy is taken from Elland for traction, the U.D.C. will, it is understood, approve of the Bill of the West Yorkshire Tramways Co., under which it is proposed to link Halifax and Huddersfield with tramways, *viâ* Elland.

Keynsham.—The R.D.C. has decided to oppose the proposed extension of the electric tramways from Bath to Saltford.

Kilmarnock.—As the result of the working of the tramways for the year from December 10th, 1904, the receipts from passengers have been £8,289; miscellaneous receipts bring the total up to £8,543. The total car-miles run were 282,693; total passengers carried, 2,148,493. This gives an average of ·92d. per passenger carried. The working expenses are estimated to be £6,200, leaving a gross profit of £2,343. Interest and repayment is estimated to absorb £2,300, leaving a net balance of £43. The total receipts per car-mile averaged 7·22d. The estimated working expenses come to 5·24d. per car-mile.

Leeds.—The Tramways Committee of the Leeds Corporation last week considered the question of arranging for the conveyance of material to the site of the new filter beds at Far Headingley. It was decided to establish connection between the tramways and the North-Eastern Railway Co.'s system in Cardigan Road, whereby materials to the extent of 80,000 tons may be conveyed.

Liverpool.—On Monday morning last at about 8.25 a heavily-laden tramcar came to grief on one of the steepest inclines of the Liverpool tramways, that of Leece Street. The car had stopped at a stage on the upper part of the incline safely. On starting to proceed down the lower and steeper part, control over the car was lost. At the bottom of the incline the track turns by a rather sharp curve into Renshaw Street. Owing to the momentum attained in moving down Leece Street, the car left the rails at the curve and fell over bodily, striking a set of iron guard posts which had been fixed by the side walk as a protection to pedestrians and to the shop property in the event of an accident of the kind. The car was fitted with one of the permanent tops having glazed sashes, now generally used on the Liverpool tramways. The glass of the top and of the body of the car was completely shattered, the pieces falling among the passengers. Some 28 persons are known to have been injured, some seriously; most of them were taken to the Royal Infirmary or to the Northern or Southern Hospital of the city, suffering from fractures, cuts, bruises and shock. On Sunday night and early on Monday morning there was a sharp frost in Liverpool, and a coat of rime formed on buildings and roads. The tram metals consequently became greasy after being used by the early morning cars. The car which overturned was removed to the Lambeth Road works of the Liverpool Corporation, and was examined. The brakes were said to be found in perfect order. It was surmised, therefore, that after being started on the incline, the momentum which the car attained through having a full load of passengers, and the rails being greasy, caused it to skid when the brakes were applied, and to leave the rails partly owing to the wheels being locked through the brakes being hard down.

The adoption of the present permanent tops for tramcars in Liverpool greatly altered the distribution of the weight borne by a fully-laden car as regards its incidence in affecting the stability of a moving car and its momentum when moving down one of the steeper inclines. In the report of the Liverpool tramways department for the year 1902, it was shown that by the adoption of the fixed top, the seating capacity of the upper deck of the standard car had been increased from 34 to 42, and that the inside seating capacity was 22. The number of passengers carried inside a car at times when the traffic is heaviest, in the morning and evening, exceeds this number by any number not exceeding 9, so that the inside complement might number anything up to 31. Yet with these greater numbers inside the car, there would be from 40 to 42 outside, as passengers are not supposed to stand in the car unless the whole of the seats on the upper deck are occupied. Assuming that no passengers were standing in the car, and that the upper seats were all occupied, there would be 22 persons in the car and 42 on top. The probable effect of this disproportion in weight has opened up fresh questions in Liverpool which will have to be very carefully studied with a view to determining the liability of heavily laden cars to skid or to turn over at curves at the bottom of hills. It is a significant fact that of the three serious accidents which have occurred on the Liverpool electric tramways, two have been on curves at the bottom of steep gradients, and one on a curve which occurred midway on a gradient, the cases being the Leece Street accident on Monday last, the Fitzclarence Street accident and the Royal Street accident, which occurred some three years ago. Except that the cars in the two earlier cases did not turn over, the behaviour in each of the three cases was very similar. Liverpool has been exceedingly fortunate in respect of immunity from really serious tramway accidents. The accident which occurred in Pembroke Place on February 4th, 1901, by which two men were killed through a fall of telephone wires across trolley wires, though commonly spoken of as a tramway accident, was not such an accident in the proper sense of the words. The ratio of fatalities to passengers carried on the Liverpool tramways each year since the Corporation took over the tramways in 1897, has been:—In 1898, 1 to 6,000,000; 1899, 1 to 8,000,000; 1900, 1 to 7,500,000 (made up of horse tramways, 1 to

5,000,000; electric tramways, 1 to 10,000,000). In 1902, 1 to 13,667,000; 1903, 1 to 28,264,308; and in 1904, 1 to 19,440,444. The ratio of fatalities to passengers carried on the railways, as shown by recent Board of Trade returns, has been 1 in 1,030,917. The accident of Monday last and the previous accidents on inclines referred to, have, however, raised doubts as to the wisdom of the present system of working the tramways at Liverpool, with respect to overloading cars on the routes on which the steeper gradients occur.

London.—St. Pancras.—A deputation from the B.C. is to wait upon the Highways Committee of the L.C.C. to urge the necessity of reconstructing for electrical traction the lines of tramways from Holborn to Hampstead at the same time that the first of the lines in other parts of London north of the Thames are dealt with.

L.C.C.—At the meeting on Tuesday, it was decided to sanction expenditure for the acquisition of sites for sub-stations at Woolwich and Islington, and car-sheds at Plumstead and Stamford Hill.

The Highways Committee reported that the tramways in Goswell Road between Clerkenwell Road and Upper Ashby Street should be reconstructed at once on the conduit system in connection with the street widening works. The cost of the work was estimated at £13,800.

Baker Street and Waterloo Railway.—It is expected that this line will be opened for traffic early in March. Trial trains are now being run over the line, which will eventually be 5¼ miles in length, and will provide traffic facilities on a route where at present practically none exist.

Camberwell.—The B.C. is to present a petition against the London Southern Tramways Bill, and a petition in favour of the L.C.C. Tramway Bill. It is also to petition in favour of the L.C.C. Electric Supply Bill and against the Additional Electric Powers Supply (London) Bill. The work of reconstructing the Denmark Hill railway bridge in connection with the new Dulwich tramway has been commenced.

Maidstone.—The first eight months' record of the municipal tramways shows a surplus of profit of £1,531 after payment of £394 interest and £132 on loans. The capital outlay amounts to £26,108. The tramways are under the control of Mr. Hoadley, borough electrical engineer.

Mexico.—From the *Board of Trade Journal* we note that application has been made for the utilisation of the water power of the River Oro in the state of Guerrero, and that a contract has been entered into with a Mr. A. Stein for the appropriation of 60,000 litres per second from the River Saqui (Lonora) for industrial purposes.

Middlesex.—The Light Railway Commissioners held an inquiry at the Guildhall, Westminster, on Friday with reference to an application on behalf of the Middlesex County Council in regard to a proposed electric tramway, 5¼ miles in length, in the portion of the parish of Wembley commencing in Harrow Road, at the termination of the already authorised light railways, and passing along that road to a point near the Wembley-Harrow parish boundary. Strong opposition was offered to the scheme on behalf of local residents. Ultimately it was stated on behalf of the County Council that it would withdraw that portion of the proposed line from the Swan Inn, Sudbury, to the Wembley-Harrow parish boundary. Upon this several opponents said they would not offer any further objections. The chairman of the Commissioners said that it had been previously intimated that the Commissioners would not consider the proposed line unless it was part of a larger scheme. Mr. G. A. Wakelam, engineer to the County Council, contended that the line was part of a larger scheme. Mr. Lloyd, K.C., for the opposition, argued to the contrary. In the result, the inquiry was adjourned.

Northwich.—The R.D.C. has decided to lodge objections with the Light Railway Commissioners against the extension of the time limit for constructing the Warrington-Northwich Light Railway, it being considered that the extension would be prejudicial to the interests of the district and would prevent development.

Penang, F.M.S.—We learn from the *Penang Gazette* that the official trial run of the municipal electric tramway took place on the 29th ult. and the system was opened to the public on New Year's Day. The company, after the trip, adjourned to the Town Club, where Mr. O. V. Thomas, the engineer responsible to Messrs. Preece & Cardew, was congratulated upon the completion of the work. The contractors for the permanent way and overhead equipment were Messrs. Dick Kerr & Co.; for the rolling stock and car motors, and controllers, the Brush Co. and the B.T.H. Co. respectively. Mr. R. Young supervised the laying of the permanent way, and Mr. T. S. Allen the overhead work.

Railways and Electric Traction.—At the half-yearly meeting of the East London Railway Co. on Tuesday, Lord Claud Hamilton said that the most uncomfortable feature with regard to passenger traffic was the result of the electrification of the Metropolitan District Railway. From August 1st last they took off their through trains from Hammersmith to New Cross, and the London, Brighton and South Coast Railway Co. undertook to carry on the local service from Whitechapel Junction to New Cross; whilst the Metropolitan District took off 37 through trains, the Brighton Co. undertook to do the local work with 28 trains. Not only was the decrease in the number of the trains to be regretted, but they all knew from personal experience how the fact of having to change in the middle of a through journey caused great inconvenience and dissatisfaction to the travelling public. So long as the passengers were compelled to change along that route he was afraid there was not very much prospect of an increase in their passenger traffic, or even of their being able to maintain the traffic at the present rate. The Metropolitan Railway Co. was still running through trains by steam to New Cross, but so soon as the electrification of their system was completed up to the Whitechapel Junction, that, again, would stop their through journeys. If the line was electrified up to New Cross it would no doubt add materially to their traffic receipts, and restore the company to the position which it occupied prior to the electrification of the District Railway. It was easy to say that, but it was exceedingly difficult to give effect to it. He did not pretend to be an expert in the matter of electricity, but he had the advantage, as chairman of one of their large railways, of having the very best expert advice at his command, and he was not at all convinced in his own mind that the third-rail system was either the best mode of electrifying a railway or the most economical and profitable means of working it. His opinion had been rather confirmed by the unsatisfactory working of the Metropolitan and District Railways since they were electrified. As regarded the financial side of the question, judging from the report of the Metropolitan Railway Co. just issued, it appeared to him that it was very doubtful whether the third-rail was the best system, and there was no question that it was a very costly way of electrifying and working a railway. The only mode of electrifying their line would be either to do it themselves or by means of the District or Metropolitan Railway, or the action of the leasing companies as a whole. One of the leasing companies were so convinced in their own minds that the third-rail was not the best that they had just let a contract for the overhead system from London Bridge to Victoria Station, and they maintained that the electrification could be carried out, roughly speaking, at two-thirds less cost than by the third-rail system. In face of that, and until the experiment had been tried, they might be quite certain that the Brighton Co. would be no party to electrifying their line on the third-rail system, and, therefore, he was afraid that the electrification of their line must be postponed until it was proved which of the two modes was the most efficacious and economical.

In the L.B. & S.C. Railway half-yearly report the following statement appears: "Several difficult and unexpected problems had to be solved before the work of equipping the South London line for electric traction could be commenced, but the directors hope that these difficulties will shortly be overcome and the work put in hand. They propose to equip the whole of the South London line from London Bridge to Victoria."

The Metropolitan Railway half-yearly report says:—"During the half-year the services of electric trains have been considerably extended, and the Inner Circle service is now being worked entirely by the new power, in addition to the local service between Baker Street and Harrow and between Harrow and Uxbridge. Several of the electric locomotives ordered have been delivered and tested and are working traffic on the Harrow line. The work undertaken by the Great Western Railway Co. of electrifying the Hammersmith and City line is proceeding, and the new rolling stock for that service is being built. Until that has been delivered and the equipment of the line completed, it will be impossible to dispense altogether with steam locomotives, or to obtain the full advantage of the accelerated service which the electric trains are able to provide. Substantial reductions have been made in the fares to and from the City stations, with a view to meeting competition, and the results up to the present time are satisfactory."

The Argentine.—The Government has approved the statutes of the Sociedad Belga Argentine de Tramways, which has been formed with a capital of 14,000,000fr. to take over the electric tramway powers recently granted by the Buenos Ayres municipality.—*Review of the River Plate.*

United States.—According to an American contemporary, another fast electric line across New Jersey to the seashore is to be constructed this year. Chicago financiers have virtually closed with W. J. Thompson, of Glasgow City, to build a direct line between that town and Atlantic City, for which Mr. Thompson has held right of way several years. The cost of placing the line in operation is estimated at $6,000,000, and the Chicago capitalists are prepared to rush the project. The line will be operated by the third-rail system exclusively, as a private right of way will be used. Where public roads cross the electric line, overhead bridges will be built for the public thoroughfares, and there will be no level crossings. With the shorter route provided, it is believed that three-car trains can make the trip in 65 minutes. The action of the Chicago financiers in taking up the construction of this line directs attention to the interest displayed by other Western capitalists in electric railways in the East. They are building the Philadelphia and Western Railroad, which will compete with the Pennsylvania for suburban traffic west of the city. This road has been financed by St. Louis capital, and G. J. Kobusch, president of the St. Louis Car Co., is president of the company. It is declared that the line will be ready for operation within six months. Electricity is making itself felt slowly but surely as a means of railroad locomotion, and it is not improbable that within a decade many steam railroads now running in and out of the big cities will be electrified. Hitherto the electrification of steam roads has been confined practically to terminal facilities and local service over short distances, so that the recent decision of the Pennsylvania Railroad to equip electrically a portion of its system between Camden and Atlantic City, New Jersey, is of the greatest interest. That portion of the Pennsylvania Railroad to be electrified comprises 64 miles of steam road lying between Camden and Atlantic City. The route includes the station of Newfield, between which city and Camden there is already a double-track line. The double tracking will be continued to Atlantic City, following the

line of the single track already existing between that city and Newfield. Over this double-track line an express electric service will be established, cars having a headway of 15 minutes, and making the run from Camden to Atlantic City in 80 minutes. The maximum speed of the cars will be between 55 and 60 miles per hour. The third-rail system will be used throughout, except on the section between Camden and Woodbury and Newfield and Millville, where the cars will be run on overhead trolley, the speed on these sections being less than on the main line. Power for the operation of the cars will be supplied from a power house located at Camden, and will be transmitted at a pressure of 33,000 volts to six sub-stations between Camden and Atlantic City, and the seventh sub-station at Millville to supply that section of the line between Millville and Newbury.

West Ham.—On Tuesday, the Corporation resolved that on the B. of T. agreeing to sanction the borrowing of £80,126 for tramway purposes, the Council would not raise any further sums for such purposes under the provisions of Sec. 73 of the Act of 1890, beyond the sum already raised, viz., £154,240. The Council when next promoting a Bill in Parliament, is to apply to repeal the unexercised borrowing powers for tramway purposes conferred by the 1900 Act.

Wigan.—At a meeting of ratepayers on January 18th, a resolution was passed consenting to the promotion by the Corporation, jointly with the Preston, Chorley and Horwich Tramways Co., of a Tramways Bill for the purpose of authorising the T.C. to carry into effect clauses of the Bill, enabling the Council to purchase 2½ miles of the proposed tramways for £27,000.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The *Review of the River Plate* states that there is such a large movement of telegrams between Buenos Ayres and Mendoza that the construction of new lines is now absolutely essential. At the present time there are only two lines, the same as 20 years ago. The Cuyo Provinces have gone ahead so much of late years that the present lines are inadequate.

Continental Notes.—Spain.—The *Gaceta de Madrid* of January 12th publishes a law sanctioning a special credit of 100,000 pesetas (about £3,327) for repairs to submarine cables.—*Board of Trade Journal.*

The same issue of the *Gaceta* publishes a notification to the effect that the Eastern Tramways Co., of Madrid, has obtained the concessions for the construction of the electric tramway in that city, of which particulars were published on p. 582 of the *Board of Trade Journal* of September 28th, 1905.

The Compagnie Interurbaines des Telephones is stated to have given its sanction to the joining of its lines with the Madrid systems, so that Madrid subscribers may be able to communicate directly with Barcelona, Valencia, Bilbao and the other chief Spanish towns.

Italy.—The *Gazzetta Ufficiale* (Rome) of January 10th contains a Law sanctioning the expenditure of 2,500,000 lire (about £100,000) by the Minister of Posts and Telegraphs on the erection of new telegraph lines and the improvement of existing lines between the following towns:—Genoa and Messina, Naples and Turin, Bari and Florence, Reggio (Calabria) and Naples, Rome and Venice, Genoa and Milan, Florence and Milan, Milan and Venice. The expenditure is to be spread over a period of seven years; 300,000 lire (about £12,000) is to be spent in each of the years 1906-8 and 400,000 lire (about £16,000) in each of the years 1909-12.—*Board of Trade Journal.*

Telephonic experiments have recently been made between Rome and Strasburg, and Rome and Brussels, with the Angelino microphone. Experiments have also been made with the Majorana microphone between Rome and London, a distance of 2,000 kilometres.

Delay in Connection.—Writing to the *Times* of 22nd inst., Mr. E. S. P. Haynes, of Lincoln's Inn, says:—"On December 14th last the manager of the Post Office London Telephone Service wrote to inform me that an agreement for an exchange line at my private address had been accepted on behalf of the Postmaster-General. After frequent inquiries without result, I am to-day informed that no definite date can be given for the completion of this exchange line, but that the minimum period for this installation is three months from to-day. Before this date not the slightest intimation was given to me that there was any hitch in the matter, and the manager informs me that he is unable to obtain from the engineers any estimate of time. In December, I was informed that the installation would be made within five weeks of the 14th ult."

Liverpool.—In accordance with a custom inaugurated by the late Charles Birchall, of Liverpool, the proprietors of the *Journal of Commerce* lately organised a collection among business men and telephone users on behalf of the lady operators of the Liverpool Telephone Exchange, as a Christmas and New Year's gift. The collection realised the sum of £314 10s. 2d., which has been handed over for the members of the staff in question.

London.—St. Pancras.—The B.C. has refused an application by the Postmaster-General for permission to erect iron poles on the public way in Granley Street. The local authority holds that the wires should be put underground.

Lord Stanley and the Telegraphists.—It is stated that the postal employés put forward every effort to assist in unseating Lord Stanley, and on the announcement of the result of the election a number of abusive telegrams, exulting in his defeat, were sent to him. Amid this disgraceful exhibition of bad taste and ill-manners, it is pleasing to note that the female staff have telegraphed to Lord Stanley dissociating themselves from an "undignified and unladylike" telegram purporting to come from them, but really emanating from a small minority.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Keissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Port Arthur-Chifu (Closed)	Mar. 7, 1904	
Jamaica-Colon	Jan. 5, 1905	
Cadiz-Tenerif	July 20, 1905	
Tarifa-Tangier	Jan. 18, 1904	
Puerto Plata-Martinique	Oct. 30, 1905	
St. Thomas-St. Kitts	Dec. 28, 1905	
Manila-Iloilo	Dec. 28, 1905	Jan. 8
Bolama-Bessao	Jan. 19, 1906	
Landlines.		
Puerto-Barrios	Aug. 28, 1902	
Kertch-Soutchoum	Sept. 27, 1904	
Communication with Brazil *via* Galveston	July 18, 1905	
Communication with Alaska *via* Seattle	Jan. 17, 1906	

Venezuela.—M. Taigny, the French representative in Venezuela, boarded a French cruiser, the *Martinique*, to obtain dispatches, without the Customs authorities' permission, and was not allowed to land again. He was therefore taken to Willemstad, in Curaçao. The French Government have given the Venezuelan representative at Paris 24 hours' notice to leave French territory. Owing, says the *Standard*, to the absence of direct messages from Caracas, the French Government itself has been rather in the dark as to what was happening. It appears, however, that France is agreeing with the upholders of the "Monroe" doctrine on the steps to be taken by her. The French fleet consists of the *Martinique*, *Desaix*, *Jurien de la Gravière* and the *Troude*.

The *Constitucional* publishes the correspondence which preceded the rupture between France and Venezuela. It maintains that the complicity of France in the "Matos" revolution is proved, and adds, says a Reuter dispatch, "We do not accuse the Cable Co. but the French Government for privately ordering the managers of the Cable Co. to transmit information to the revolutionists." It appears also that various telegrams from France to her representative have been intercepted, as they did not reach their destination.

It is also rumoured that President Castro wishes to lay a cable from La Guayra to Puerto Rico. Messages are being conveyed from Trinidad to Amacura, Venezuela, by gunboats, and are thence sent on by telegraph. Senders may not employ registered addresses, and must take all risks. Censorship has been established at Amacura. Messages must be routed "*viâ* Trinidad-Amacura," and this indication, contrary to usual custom, must be paid for.

Wireless Telegraphy.—The Italian Ministry of Posts and Telegraphs has appointed an Electrotechnical Commission, presided over by Signor Blasena, to report upon the most suitable system of wireless telegraphy to employ as a means of communication between the mainland and the islands of Sicily and Sardinia, an instruction to the Committee being to the effect that the cost should not exceed £16,000.

A Laffan New York telegram states that the following telegram was received at Portland, Maine, by wireless telegraphy:—"The drydock *Dewey* is approaching Gibraltar." The distance travelled over by this message is more than 3,000 miles, says the telegram, and is believed to be a record of long-distance transmission.

The United States Atlantic Fleet has begun a series of elaborate manœuvres which will last until April. The cruisers now stretch in a long chain to mid-ocean, communicating with each other and their bases by wireless telegraphy.

Reuter telegraphs from Newfoundland that the Marconi Co. proposes to extend its wireless telegraph system at Cape Race to other Newfoundland centres. By this means, utilised in conjunction with the Colonial Government telegraphs, regular commercial communication between ships in mid-ocean and Europe and America will be greatly facilitated. The Government is now considering the proposals. Last week Cape Race and the Cunard liner *Lucania* were speaking over a distance of 760 miles.

An Electricity Works Hero.—Two employés at the Bath electricity works—an engineman and a stoker—plunged into the River Avon to save a boy who had fallen in. The river was much in flood, and although the engineman (James Gibbons) succeeded in reaching the boy, the current proved too strong for him, and both man and boy were drowned. A local subscription list has been opened on behalf of Gibbons's widow and four children.

THE POST OFFICE TELEPHONE SYSTEM.

The "City" Exchange.

It is not yet four years since the Post Office Department opened its first London telephone exchange in that portion of the General Post Office (South) which is bounded by Carter Lane, Bell Yard, Knightrider Street, and Addle Hill.

Designed to accommodate 14,040 subscribers, already more than five-sixths of its capacity has been allotted to subscribers. By the end of December about 12,000 direct lines and 5,300 extensions, representing a total of about

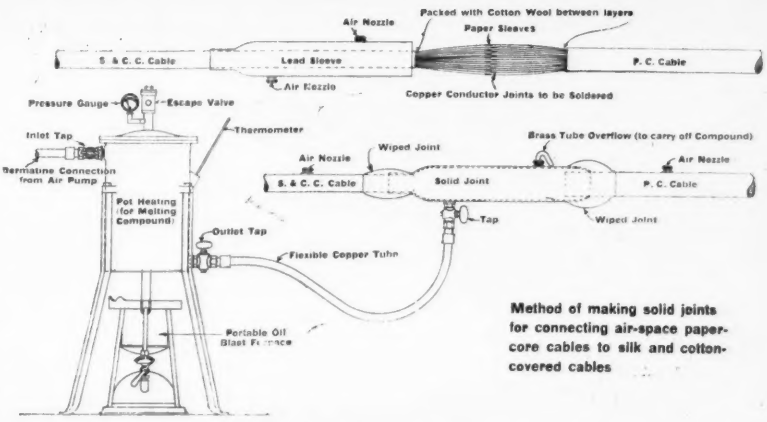

Fig. 3.—Jointing Process.

Fig. 1.—"City," Exchange: General View of Test Room (During Construction).

17,300 stations, had been connected up to this great exchange, now known to the merchant princes in the "Square Mile" as the Central.*

In anticipation of the Central reaching its limit at an early date, the Department has constructed in the same building a second exchange, to be known as the "City."

As many improvements and not a few novel features appertain to this new exchange, and render it the most up-to-date installation in Europe, if not in the world, we present our readers with an account of its main characteristics.

* This exchange was fully described in our issues of December 6th and 20th, 1901, and January 3rd, 1902.

The test room, a general view of which is given in fig. 1, is fireproof throughout, and is isolated by means of iron doors from the portion of the basement leading to the "Central" test room. It is situated on the Knightrider Street side of the building. The switch room, and the room containing the intermediate distributing frame, relay and meter racks, &c., are located on the second floor.

Sub-Basement.—Under the test room is a sub-basement for the accommodation of the main cables from the streets. It is 72 ft. long by 30 ft. wide, and being lined through-

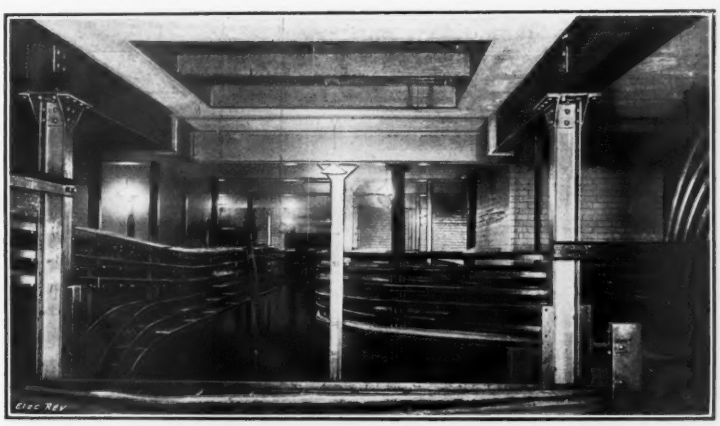

Fig. 2.—"City" Sub-basement.

out with white glazed bricks, has a clean and light appearance.

At its east end 110 conduits, running from Queen Victoria Street to the "Central" sub-basement, are intercepted, so that cables from the south and west of London can be led at will to the "Central" or the "City" test room.

For cables from the north and east, 64 conduits, recently laid in Addle Hill, terminate in a large jointing chamber connected by a shaft to the "City" sub-basement.

Heavy **L**-iron bearers run from the conduits to two chutes leading to the test room, and carry slate slabs on which the cables are laid.

Fig. 2, p. 139, gives a general view of the sub-basement.

The street cables (paper-core) are joined to indoor silk and cotton-core lead-sheathed cables, the joints being filled under air pressure with an insulating compound by a special process, a description of which may prove of interest. The arrangement is shown in fig. 3, p. 139. Before the compound is forced in, the cable is tested for insulation, which is raised, if necessary, by applying a desiccator. The compound is put in a melting pot having a screw-down cover, and is placed over a blast furnace until the whole of the compound is liquefied, the cover being screwed down until this is accomplished. The air pump is then joined to an inlet tap on the melting pot, the outlet tap remaining closed. The flexible copper tube is joined to the outlet tap, and after being warmed by means of a torch-blowing benzoline lamp, and in order that the tube may be thoroughly heated, a quantity of compound is allowed to flow through it into a bucket. The junction with the lead sleeve is then made as shown in the figures. When the temperature reaches 220° F., ascertainable by means of a thermometer inserted in a suitable socket in the side of the melting pot, all the taps are opened, and an air pressure of 20 lb. is maintained. About a gallon of the compound is allowed to flow through the joint,

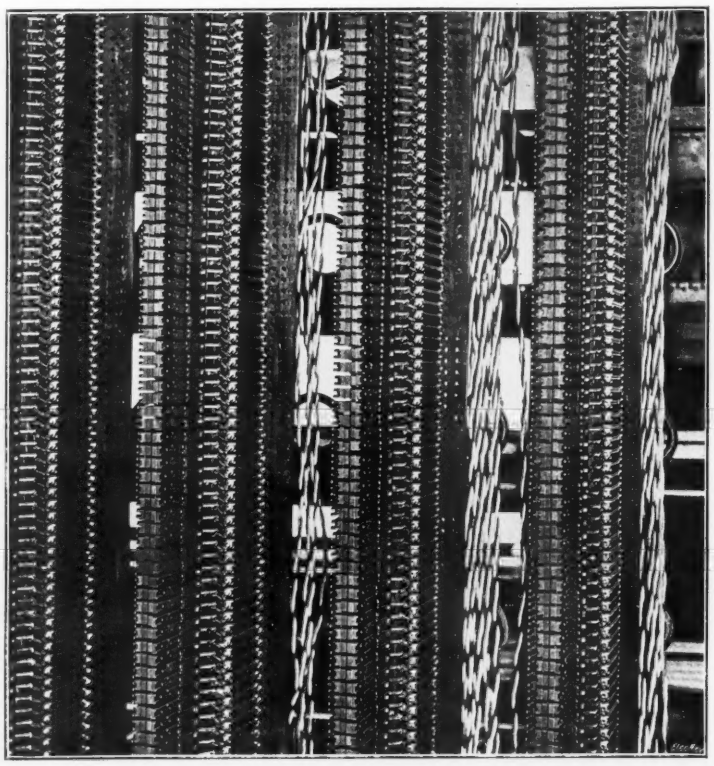

Fig. 5.—Verticals on Main Distributing Frame.

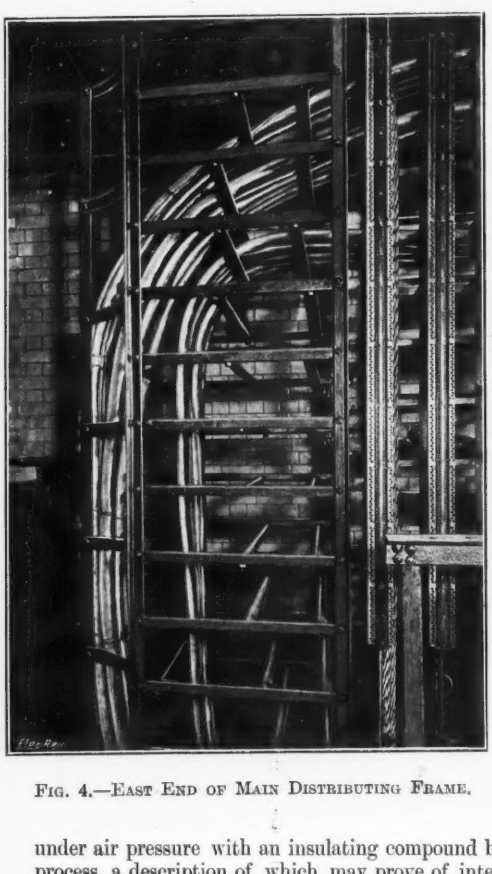

Fig. 4.—East End of Main Distributing Frame.

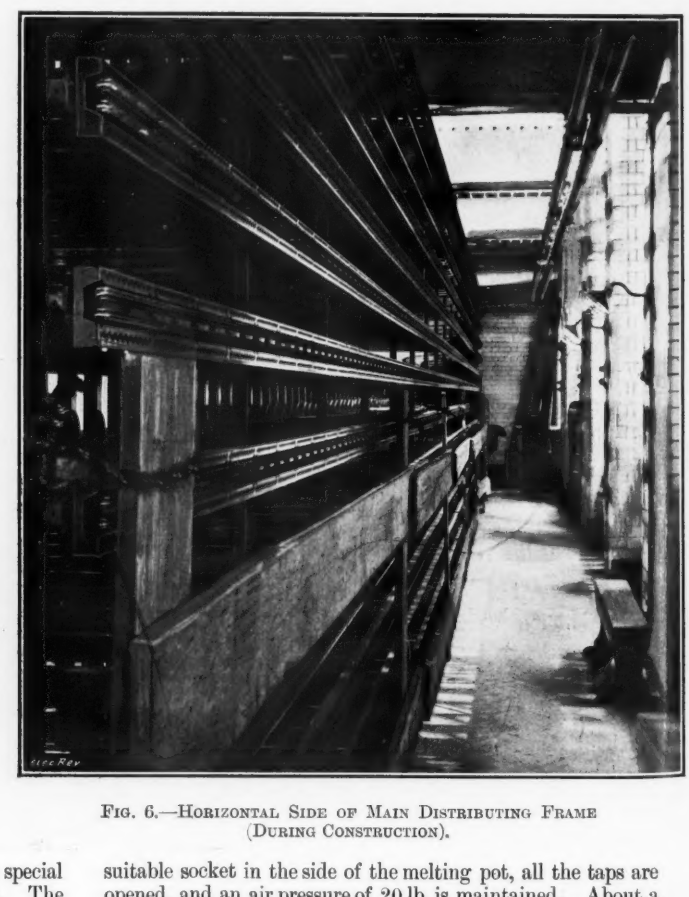

Fig. 6.—Horizontal Side of Main Distributing Frame (During Construction).

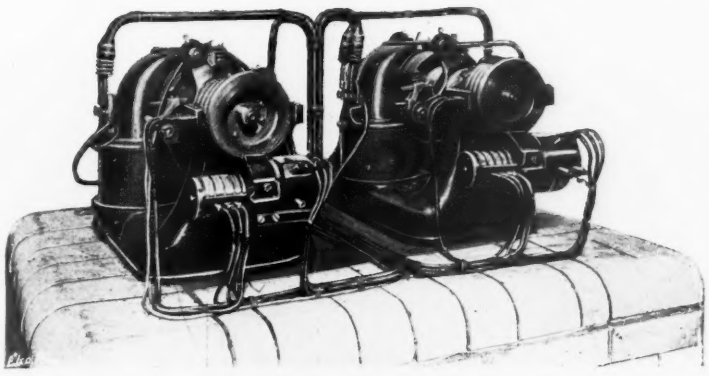

Fig. 7.—Ringing Machines.

creasing the carrying capacity of the outside conduit system.

Basement Test Room.

A plan of the basement of the building is given in fig. 13, p. 143, which shows the location of the main test frame, and the power and other heavy plant for both the City and Central Exchanges.

Main Distributing Frame.—The most striking feature in the Test Room is the main distributing frame, occupying the whole length, and running along the east end of the room. The frame is 10½ ft. high and 80 ft. in length. To secure strength, channel iron is used for the framework wherever possible, and to ensure rigidity a strap is fitted behind the connectors on the horizontal side at the back of the terminal strips.

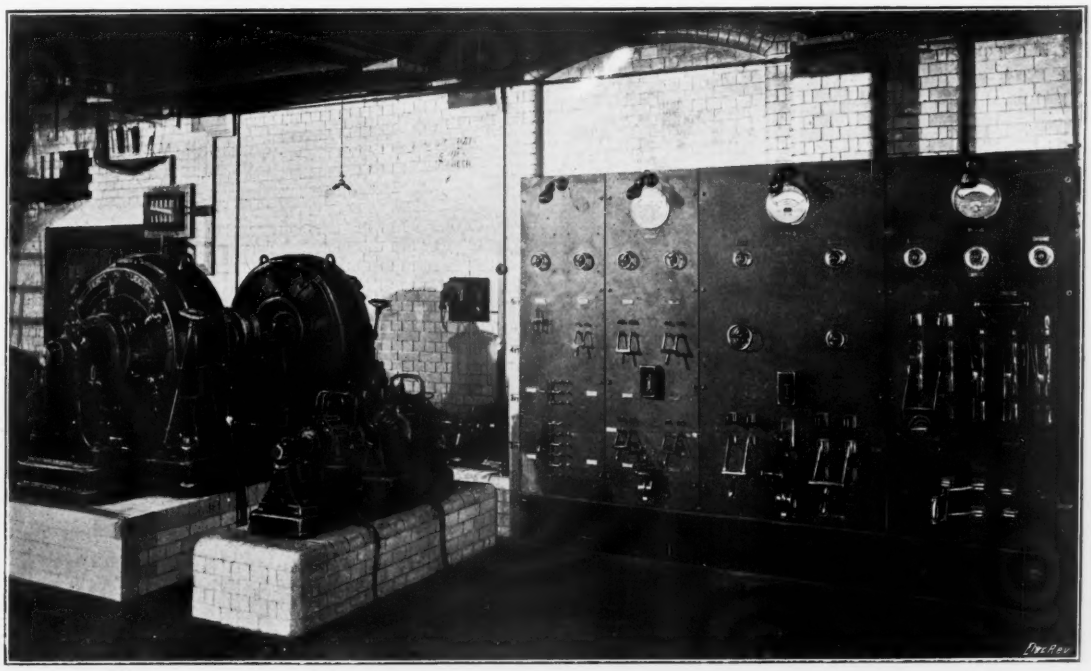

Fig. 8.—Power Board and Machines.

which is thereby heated. The tap on the lower air nozzle in the sleeve is then turned off, and the permanent cap is placed on the upper air nozzle in place of the overflow tube. This done, the compressor is re-started, and on the pressure reaching 20 lb., the tap on the lower nozzle is re-opened for five minutes in order thoroughly to fill the joint. After this interval, the joint being still under pressure, the tap on the lower nozzle is turned off, and, in order that the compound may solidify, is not unscrewed for 24 hours.

The silk and cotton core cables are carried through two openings, cut in the roof of the sub-basement, to the Test Room, which they enter, supported by special cable bearers, at the ends of the main distributing frame. Fig. 4 shows the east end of the main frame, together with the cable bearers.

It may be mentioned in passing that the number of wires in a main cable has recently been increased from 434 to 1,212, thus greatly in-

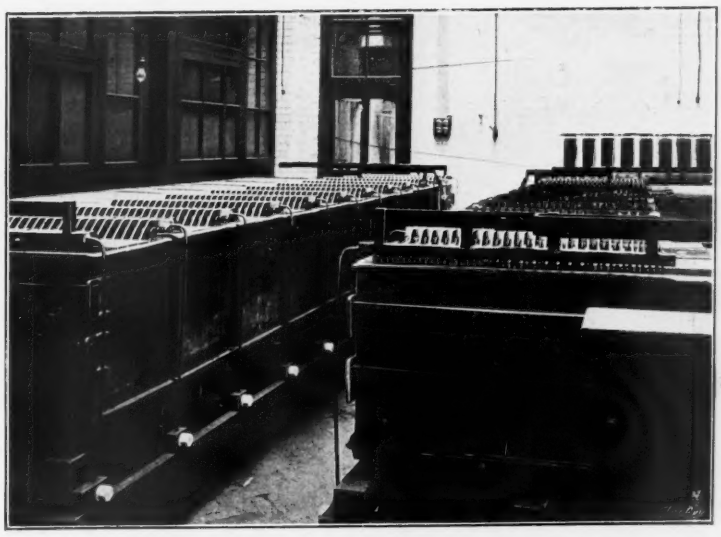

Fig. 9.—Storage Batteries.

On the horizontal side are 13 shelves, each capable of taking 2,640 lines, the total line capacity being 34,320. Fig. 6, p. 140, shows the horizontal side of the main frame during construction.

On the vertical side each strip accommodates 200 circuits. The strips are fitted with the standard form of arrester bar, with heat coils and lightning protectors, and, in addition, a fuse is fitted in each lead. In fig. 5 a portion of the vertical is shown, minus the heat coils.

The arrester bars are efficiently earth-connected by means of a 19/14 copper strand, one cable being common to all the bars on the frame.

In front, and traversing the whole length of the main distributing frame, there is an iron cable run (fig. 10) 43 in. wide by 17 in. deep, for the cables from the main frame to the chute leading to the intermediate test room. The cables are led from the cable run up the vertical side of the main frame. (In the "Central" exchange the cables are carried on bearers erected *over* the main frame.)

Racks.—Adjoining the east end of the main distributing frame are two junction coil racks, each fitted with 18 shelves: each shelf contains 56 coils, making 1,008 coils per rack.

Of subscribers' repeating coil racks there are two (erected in a small room adjoining the test room), each being fitted with 15 shelves, and

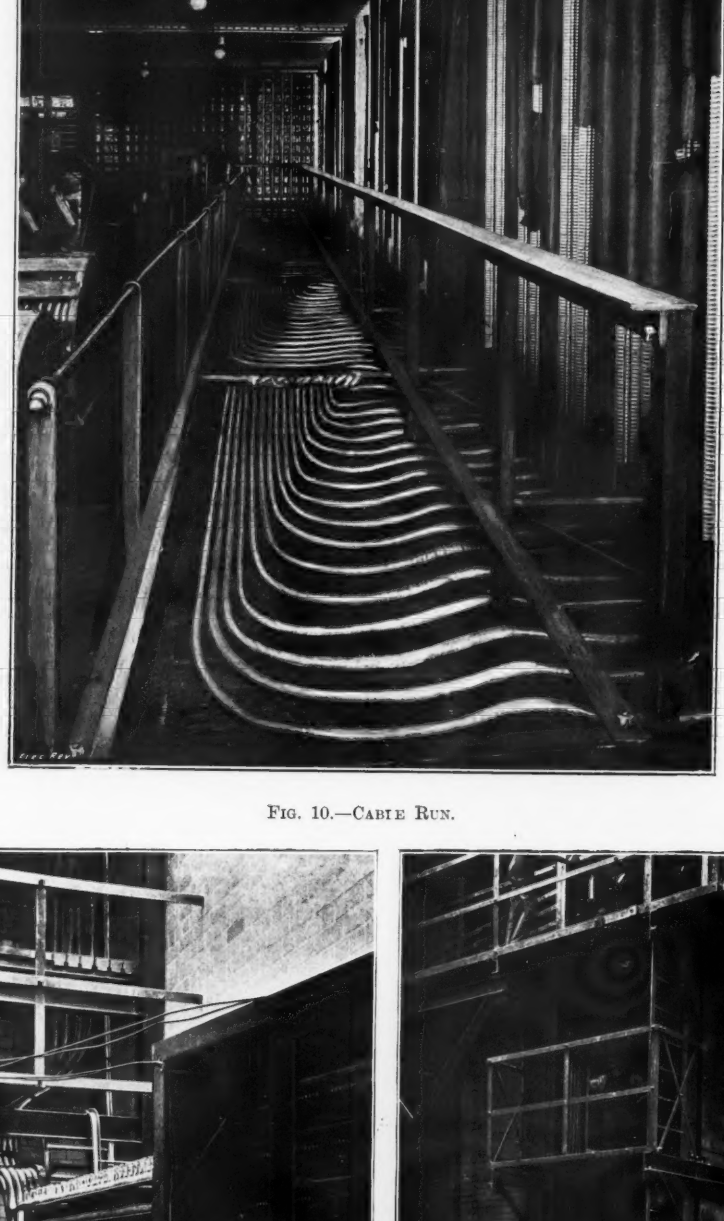

Fig. 10.—Cable Run.

Fig. 11.—Subscribers' Repeating-coil Rack.

Fig. 12.—Cable Chute.

each shelf accommodating 51 coils, the total number of coils being 765 per rack.

Each coil rack is provided with a fuse panel enclosed in an iron framework with glass front. The fuses are of the alarm type, a bell ringing when a fuse has blown. Each bus-bar is fitted with an indicator lamp to show the strip on which a blown fuse is located.

Fig. 11, p. 142, a reproduction of a photograph taken during the erection of the exchange, shows one of the subscribers' repeating-coil racks, together with its fuse panel, a few of the repeating-coil cables, and the lower end of one of the cable chutes.

The incoming junction condensers are on racks secured to the top of the junction-coil racks.

Power Plant.

Batteries.—The batteries occupy a room adjoining the test room. The main batteries to supply the current required for speaking and signalling are of the Chloride Co.'s make, and consist of two sets of 11 C.M. No. 24 sections in C.M. No. 46 boxes, having an ultimate capacity of 6,820 ampere-hours, and a present capacity of 3,000 ampere-hours at an 8-hour rate. The tanks, which are of lead, and measure 7 ft. 6 in. × 1 ft. 9 in. × 1 ft. 9 in., stand on glass oil-cup insulators placed on a heavy wooden framework, resting on solid earthenware blocks. Each cell when full will weigh about 2 tons. Fig. 9, p. 141, shows the batteries. Fuses of the "D and W" type, mounted upon slate bases, are placed adjacent to the cells and in the main leads.

A smaller battery, also supplied by the Chloride Co., consisting of 15 S.G.3 cells in glass boxes, is installed for the purpose of operating the service meters.

Charging Machines.—The north-central portion of the test room is occupied by the power plant. Power for charging the batteries is obtained from the department's lighting system, the plant for which is situated in the south-east portion of the basement of the exchange building (see fig. 13). Current is supplied at 102 volts, and is transformed to suitable voltages by motor-generators. The large machine, situated on the left of the power board (*vide* fig. 8, p. 141), is the combination installed for charging the main batteries. The motor, of 45 B.H.P., is a four-pole machine of the semi-enclosed type. It is coupled direct to a generator of the multipolar type, mounted upon the same bedplate, and the combination is intended to run at a speed of 475 revolutions per minute. The output of the generator at full load is 30,000 watts—namely, 1,000 amperes at 30 volts. The machine was designed specially for common battery working, the number of the armature windings and commutator segments being such that it is possible not only to charge the cells whilst they are connected to the lines without producing noise on the subscribers' circuits, but also, if necessary, to supply current for working the Exchange independently of the batteries.

There is a motor-generator of small capacity (shown in fig. 8 to the right of the large machine) for charging the 15 cells constituting the meter battery. The motor of this combination, like the one already described, is designed to operate on a 102-volt circuit, while the output of the generator is 50 amperes at 35 volts. The generator is so joined up as to supply current direct to the meters when the battery is being charged.

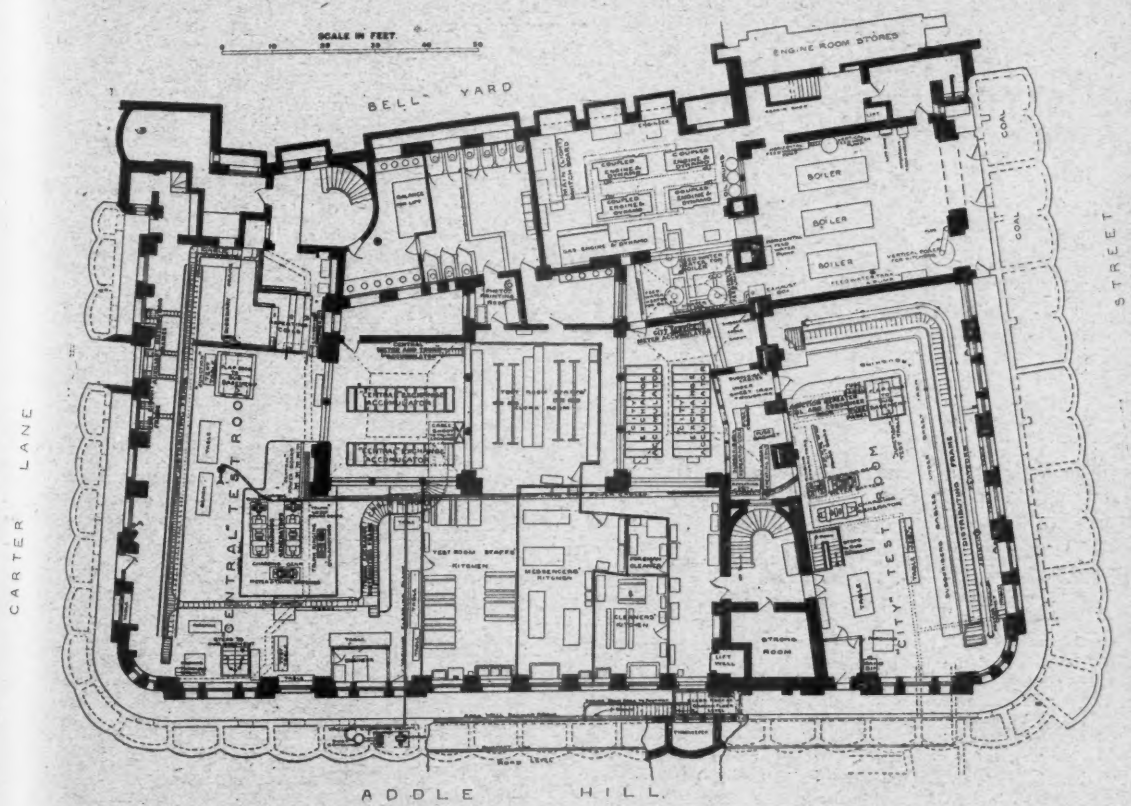

Fig. 13.—Plan of Basement.

The charging plant in the City Exchange is not in duplicate, there being already two sets of machines in the Central Exchange, and arrangements having been made for the supply of power from either Exchange to the other.

Ringing Machines.—Two "dynamotors" (fig. 7, p. 141) supply current for ringing purposes and for operating the interrupters required for machine ringing and tone-test purposes. The machines, which are of the semi-enclosed type, are designed to operate on 105 and 30-volt circuits respectively. One runs from the lighting mains, and the other from the meter battery. The generators give an alternating current of 2 amperes at 75 volts, running at a speed of about 1,200 r.p.m.

Two high-speed interrupters for producing tone signals of different pitches are carried upon an extension of the armature spindle. These are used in conjunction with the meter battery and transformers, for the production of the high-frequency alternating currents required for the now familiar hum of the "busy-back" and "don't answer" signals, as well as for tone tests, one of which is placed upon faulty lines, and the other upon subscribers' circuits when connected

to the trunk system. The two latter signals are distinguished by the difference of pitch given to the tones, while the "busy-back" and "don't answer" signals are distinguished by interruptions which break up the hum into a regular series of uniform short notes in the one case, and a series of alternating long and short notes in the other. These, as well as the interruptions introduced into the machine-ringing circuit, are produced by means of a slowly revolving drum mounted at right angles to the ringing machine armature spindle with which it gears.

Power Board.—The whole of the power plant is operated from the Power Board, which is of slate supported in an iron frame. There are four panels, one (on the extreme left) for the ringing machines, the next in order for the meter battery and motor-generator, the third for the main motor-generator, and the fourth for the main batteries. (See fig. 8, p. 141.)

Upon the front of the Ringer panel there are four switches and two hand-wheels. The upper switches are for connecting the motors to the mains. Over them are the hand-wheels operating the corresponding starting boxes mounted at the back of the panel; under them are the ringing and signal switches connecting the ringing leads, and the tone-test, "busy-back," &c., circuits to either of the machines.

Upon the meter panel are placed the starting-box and shunt coils of the motor-generator, with their controlling hand-wheels; a polarised relay and a circuit-breaker which are in the generator circuit; and the switches for connecting the motor to the supply mains and the generator to the meter cells. An ammeter placed at the top completes the equipment of this panel.

Upon the two remaining panels the apparatus controlling the main power supply of the exchange is placed. A single-throw double-pole switch connects the motor to the supply mains. Three switches associated with the charging circuit render it possible to charge either set of batteries either from the local generator or from the machines in the Central Exchange, while, if necessary, the local generator may be connected to the Central Exchange to supply charging current to the batteries there.

A Western Electric Co.'s 1,000-ampere circuit-breaker with auxiliary shunt tripping coil, and a polarised relay (both of which are placed in circuit with the generator) may be seen on the third panel, at the top of which an ammeter and two instrument switches are mounted. Two switches associated with the discharge circuit provide facilities for connecting either of the local or the Central Exchange batteries to the discharge leads, and it is also possible to connect either of the "City" batteries to the old Exchange. One of these switches (three-pole, double-throw) closes one battery circuit before opening the other, and is so arranged therefore that resistance is introduced and cut out of circuit during the change-over process.

The space at the top of the battery panel is occupied by a voltmeter which, by the agency of three switches, can be bridged across any individual cell in the main batteries, or any one of the three batteries, or the generators, or the leads running to the Central Exchange.

A Kelvin & James White recording ammeter with a 500-ampere shunt, which completes the Power Board equipment, is mounted on the wall near the Power Board.

The connections of the main batteries are absolutely independent: while one battery is being charged and the other discharged, there is no common part in the connections, and the discharging battery alone is earthed.

Lead-sheathed impregnated cables, laid in iron pipes, are used for the power circuits.

Cable Chutes.—Specially erected in one of the lighting areas of the building are two cable chutes for carrying the cables from the basement to the second floor. One, shown in fig. 12, accommodates the cables carrying the circuits between the main and intermediate distributing frames; the other the cables connecting the repeating coils to the switchboards. The chutes are substantial iron erections, with occasional platforms, to facilitate the drawing up and fixing the cables, which, for the latter purpose, pass through iron grids. Into these grids the cables are clamped by means of wooden wedges hollowed out and covered with glass paper on the side gripping the cables, and tapered slightly on the other.

(*To be continued.*)

CONTRACTS OPEN AND CLOSED.

OPEN.

Barnes.—February 12th. Steam dynamo and switchboard panels for the U.D.C. See "Official Notices" January 19th.

Battersea.—February 5th. One 750-850 or 1,000-KW. generator with piping and ejector condenser; arc lamps, globes and columns, for the B.C. See "Official Notices" January 12th.

Belgium.—February 7th. The Belgian State Railway authorities are inviting tenders until February 7th for an installation of electric lighting at the railway station at Esschen. Particulars may be obtained from, and tenders are to be sent to, the State Railway Authorities, La Bourse, Brussels.

Blackburn.—February 12th. Stores for the Electricity and Tramways Committee. See "Official Notices" to-day.

Cardiff.—February 16th. Cooling towers, electrically-driven pumps, pipe work, &c., for the Corporation Roath Power Station. See "Official Notices" to-day.

Cheltenham.—February 3rd. Stores for the Corporation (including electric light fittings). Mr. J. S. Pickering, Borough Surveyor and Water Engineer.

Clyde Navigation.—February 12th. Electrical cable and conductor installation for Clydebank Dock. See "Official Notices" to-day.

Dover.—February 16th. One 350-KW. combined steam generator set for traction purposes for the Electricity Department. See "Official Notices" to-day.

France.—January 30th. The municipal authorities of Briancon are inviting tenders until the 30th inst. for the electric lighting of the Mont Dauphin military establishments in that town. Particulars may be obtained from, and tenders are to be sent to, La Mairie de Briancon (Hautes Alpes).

Fulham.—January 31st. Steam, water and exhaust piping for the electricity department. See "Official Notices" January 12th.

Germany.—February 8th. The Prussian State Railway authorities in Hanover are inviting tenders until February 8th for the supply of 268 tons of galvanised iron wire, 13 tons of steel wire, 67 tons of bronze wire, 5¼ tons of copper wire, and 5·8 tons of insulated wire. Tenders are to be sent to Die Staatsersenbahn Direction, Hanover, Germany, whence particulars may be obtained.

Hammersmith.—February 7th. General stores for the B.C. electricity department for one year. See "Official Notices" January 19th.

Kingston-upon-Hull.—February 12th. Air space telephone cable and extension of existing multiple switchboard for the Corporation telephone equipment. See "Official Notices" January 19th.

Pontypridd.—February 13th. One 300-KW. steam dynamo for the U.D.C. See "Official Notices" January 19th.

Shanghai.—February 22nd. One 800-KW. horizontal steam turbo-alternator with condensing plant, for the Municipal Council. See "Official Notices" to-day.

South Africa.—HEIDELBERG.—The Municipality invites tenders for lighting the town by means of electricity.

Spain.—January 30th. The Spanish Ministerio de Fornento in Madrid is inviting tenders until the 30th inst. for the concession for the construction and working of an electric tramway between Santander and Ashllero. Particulars may be obtained from, and tenders are to be sent to, El Ministerio de Fornento, Madrid.

Stoke-upon-Trent.—January 31st. Meters and demand indicators for a year. See "Official Notices" January 12th.

Sunderland.—March 2nd. Feed pump, cooling tower, surface condenser, coal bunkers, &c., for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Brighton.—The T.C. has accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., for the supply of wrought-iron protective screens round portions of the switchgear at Southwick and North Road stations, at £174 and £72 10s. respectively.

Heckmondwike.—The U.D.C. has accepted the tender of the Paterson Engineering Co. for the supply of a water purification plant for the electricity works.

Johannesburg.—The Rand Water Board has accepted the tender of Messrs. C. C. George & Co. for electrical plant, amounting to £24,000.

Lewisham.—The Guardians have accepted the tender, at £125, of the Telephone & Electrical Installation Co. to provide a new telephonic installation connecting 27 points with all the necessary accessories, viz., cable junction boxes, batteries, battery boxes, &c.

London.—The following tenders have been received by the L.C.C. for the supply of about 2,300 tons of slot rails for use in connection with the reconstruction of the first section of the northern tramways:—

Steel, Peech & Tozer	(recommended)	£16,055
E. Le Bas & Co.		16,112
Frodingham Iron & Steel Co.		16,630
Walter Scott		17,550
P. & W. MacLellan		17,780
Bolckow, Vaughan & Co.		21,000

Amount of the engineer's estimate, £17,780.

Southwark.—The B.C. has accepted the tender of Mr. W. Winn, at £59 17s. 6d., for electric light fittings for stables. The tender of Messrs. Hammond & Champness was accepted last month, but was afterwards withdrawn.

Poplar.—The B.C. has received the following tenders for rewiring the Bromley Depôt and Disinfecting Station:—

Borough Electrical Engineer	(accepted)	£100
H. Pyle & Co.		115
W. Palmer		133

St. Pancras.—The B.C. received the following tenders for arc lamp columns:—

W. Lucy & Co., Ltd.		£1,045
Improved Electric Supplies Co., Ltd. ..		1,064
General Electric Co., Ltd.		1,121
Walter Macfarlane & Co. ..	(accepted)	1,120
McDowall, Steven & Co., Ltd.		1,159
" "	(alternative)	1,178
Rowland Carr & Co.		1,182
Rumney & Rumney		1,245
David King & Sons		1,265
Pontifex & Co.		1,364
Mackenzie & Moncur, Ltd.		1,520
Falkirk Iron Co.		1,539

Perth.—The T.C. Electricity Committee has accepted the tender of the British Electric Plant Co. for a motor-generator.

FORTHCOMING EVENTS.

To-day's Events (Friday, January 26th).—At 8 p.m. Physical Society. Meeting.
At 7.30 p.m. I.E.E. (Manchester Students). Mr. F. Shaw on "Electric Lamps."
At 8 p.m. Junior I.E. Prof. J. D. Cormack on "Notes on Boiler Trials."
At 7.30 p.m. North-East Coast Institution of Engineers and Shipbuilders. Meeting at Newcastle.
At 8 p.m. Electro-Harmonic Smoking Concert.

Saturday, January 27th.—At 3 p.m. Junior I.E. Visit to the Engineering Laboratories of University College. Demonstration of methods of conducting a Boiler Trial, by Prof. Cormack.
At 7.30 p.m. Glasgow Technical College Scientific Society. Mr. J. Andrews on "Cylinder Ratios."
At 3 p.m. I.E.E. Students' visit to Central Telephone Exchange of the G.P.O.

Tuesday, January 30th.—At 7.30 p.m. I.E.E. (Manchester). Mr. J. Atkinson on "Gas Engines applied to Electric Driving."
At 8 p.m. Faraday Society. Meeting at the I.E.E. "The Electric Furnace: Its Origin, Transformations and Applications" (Part 3), by Mr. Adolphe Minet; "Demonstration of a New Electrolytic Tube Furnace," by Dr. J. A. Harker; "Note on the Production of Ozone by Electrolysis of Alkali Fluorides," by Mr. E. B. R. Prideaux.

Wednesday, January 31st.—At 2.30 p.m. I.C.E. Students' visit to the L.C.C. Tramways generating station at Greenwich.

Thursday, February 1st.—At 8 p.m. Society of Arts. Prof. S. P. Thompson on "High Speed Electric Machinery." (Howard Lecture III.)
Rugby Engineering Society. Mr. C. McCarthy-Jones on "The Transmission of Electrical Energy."
At 8 p.m. Civil and Mechanical Engineers' Society. Mr. F. L. Watson on "Destructor Bye-Products."
At 8.30 p.m. Chemical Society. Meeting.
At 8.30 p.m. E.E.R.E.V. Regimental Ball at Caxton Hall.

Friday, February 2nd.—At 9 p.m. Royal Institution. Prof. S. P. Thompson on "The Electric Production of Nitrates from the Atmosphere."
At 8 p.m. Junior Institution of Engineers. At Westminster Palace Hotel. Mr. K. Edgcumbe on "Some Recent Electrical Engineering Measuring Instruments."

Wednesday, February 7th.—At 8 p.m. Society of Arts. Mr. Leon Gaster on "Progress in Electric Lighting."

Friday, February 9th.—At 7.30 p.m. I.E.E. (Manchester Students). Mr. H. A. Carney on "Electrical Instruments."
At 8 p.m. Physical Society. Meeting.

Saturday, February 10th.—Junior Institution of Engineers. Anniversary dinner at the Hotel Cecil.

Warning.—As we go to press we learn that the individual referred to in Mr. H. D. Wilkinson's letter (p. 128 of this issue) has been caught, and has received a sentence of six months' imprisonment with hard labour, while a further charge will be preferred against him on his release. We understand that he has victimised about 50 people.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Monday, January 29th.—"A" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.
Tuesday, January 30th.—"B" Company, recruits' drill, 6 p.m.; technical instruction, 7 p.m.; medical inspection recruits, 7 p.m.
Wednesday, January 31st.—"A" badge examination.
Thursday, February 1st.—"C" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.
Friday, February 2nd.—"D" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.
Saturday, February 3rd.—Week-end instruction for country members of "D" Company; "D" Company supper.

J. H. S. Phillips.
For O.C.E.E.R.E. (V).

NOTES.

Standardisation of Electrical Rules.—The following rules which were adopted at the National Conference on Standard Electrical Rules, held in New York City on December 4th, 1905, will be interesting to central station engineers more particularly:—

"That it is the sense of this conference that the grounding of low tension secondary alternating current systems be strongly recommended in all cases wherever reliable grounding connections can be secured.

"That in cases of three-wire systems with grounded neutral, solid connection, without fuse, be permitted on the neutral wire.

"That it is the sense of this conference that the grounding of secondary alternating current systems inside buildings on water pipes, provided such connection is made at nearest point to cellar wall on water pipe, and outside of meter, is not only safe, but places no additional burden or menace upon such water pipes."

We are indebted to our New York namesake for the above.

Annual Dinner of the General Electric Co., Ltd.—On Saturday last the sixteenth annual dinner of the General Electric Co., Ltd., was held at the Criterion Restaurant. The guests numbered nearly 400, and included, besides many central station engineers, consulting engineers and contractors, a number of the company's staff. In the absence of Mr. G. Byng, through ill-health, Mr. H. Hirst took the chair, supported by the Hon. Walter James, Agent-General for Western Australia, and Prof. W. E. Ayrton. After the loyal toast, the Chairman proposed "The health of the Navy, Army and Auxiliary Forces." Colonel Crompton, in reply, said that the Imperial forces were in a healthy condition, and the efficiency of the Electrical Volunteers was that of electrical men who were not playing at soldiers, but working at their business. The reorganisation of the Navy last year had placed England in a most powerful position. He hoped that the new Government would improve the lot of the auxiliary forces.

The Chairman then toasted "The Guests," and remarked that the company's order books and workshops were full last year, and considerable extensions had been carried out at Witton and Manchester. They missed a number of well-known faces, former members of the staff, of high character and ability. When weakness was discovered, they must go to the roots of the trouble, and they had come to the conclusion that these gentlemen had not come up to the standard. The directors knew their responsibilities to the staff and to their customers, and expected an equal appreciation of their duty on the part of the staff. Efficiency and "pulling together" were essential to success. They could not agree—therefore parted; the board of directors unanimously approved of the course taken. The retiring director threw a number of shares on the market, which were bought up by concerns advised by the G.E. Co.'s own auditors, a significant testimonial to their value. They expected the staff to work as hard as the directors; they might be compared with a railway company, but carried goods only—if any passengers were found, they would be turned out.

Mr. R. Dumas, of Witton Works, replied on behalf of the staff, whose confidence in the directors, he said, was undiminished by recent events. Those who were left were aware that the rewards of duty would not be absorbed by passengers, and therefore might look forward to due remuneration of their efforts if the results were favourable. He concluded by eulogising Mr. Bevis's self-sacrifice in the hour of need, and proposed his health, which was given with musical honours.

In his reply, Mr. Bevis called for deeds, not words; from the works, deliveries, not promises; from customers, cheques, not excuses.

Mr. Max Byng, proposing "The Visitors," adopted the *rôle* of the candidate for election; as inducements to vote for the G.E.C., he promised Free Trade with the G.E. Co., Protection from bad material, lower tariffs and higher discounts, Home Rule (a separate factory for each customer), education revision on behalf of consulting engineers, &c. The War Office specifications were to be revised to within 10 years of the G.E.C. catalogue. Neither Mr. Bevis nor Mr. Railing would employ Chinese labour.

The Hon. W. James, in reply, heckled the G.E.C. (General Election Candidate) with a number of interrogatories, bantering electrical engineers on their proclivity to guesswork, the weary look of his electric lamps, &c. He remarked on the world-wide appreciation of Mr. Chamberlain, and suggested that old England had the same faults as Australia—that the English were, after all,

human also, and had their own Labour troubles. He hoped that, some day, Mr. M. Byng would address an election audience in earnest.

Prof. W. E. Ayrton also replied, asking whether the candidate stood in the Conservative or Liberal interest, as the company was supposed to favour Tariff Reform, while the dinner had been conducted on Liberal principles. He referred humorously to the early days of the company, and concluded by proposing the health of the chairman, which was duly honoured.

Finally Sir R. Awdry proposed the health of the chairman of the company, Mr. G. Byng, to whom the company owed its success, and Mr. M. Byng, replying on his behalf, conveyed Mr. Byng's regret at his absence.

The company then adjourned to the concert room, where an excellent programme was performed by Miss Katie Moss, Miss May Rawlinson, Messrs. Julien Henry, Nelson Jackson and A. E. Godfrey. During the evening the London Orchestral Band performed a programme of music, including the General Electric Co.'s March, which was encored. The hospitality of the hosts left nothing to be desired, and the function was, as usual, highly successful.

Electric Current Supply and—Fish.—Passengers on the L.C.C. steamers (alas! how few they now are) have often noticed, while passing the new power station of the Underground Electric Railways at Chelsea, large numbers of seagulls circling round and round one particular spot in the vicinity. When describing the features of this station in our columns some little time back, it was remarked that the circulating water used for the large surface condensers was drawn from the Thames, and, after passing through the tubes of the condensers, returned again by a separate main to the river. Now, seagulls, especially those haunting the Thames, are discriminating birds, and would tell you, if they could, that "boiled fish" are any day more palatable than the ordinary "alive and kicking" fraternity, which, before the advent of the monster supply station, formed their daily sustenance. Thousands of small fish are drawn down the large circulating water suction main in the course of a day, and, once in, their fate is inevitable. As the temperature of the water passing through the condenser tubes gradually rises, the fish undergo a partial boiling process, eventually being "served up" to the gulls done to a nicety. As the number of turbines (and, consequently, condensers) put into operation periodically increases, so the supply of fish multiplies. Whereas, in the early days, a few "cute" gulls monopolised this fish market, the number is now increasing alarmingly. News spreads rapidly among the feathered tribe, and birds are daily arriving at the "fish supply company" of Chelsea in vast numbers. Day in day out the supply continues, and as long as fish inhabit the waters of this portion of the Thames, Chelsea will be the home of the seagull.

Electrical Ploughing Machines.—Prize Offered.—At the Milan International Exhibition there is offered an international prize of £80 for ploughing machines worked by electricity.

Electrical Engineers Volunteers.—A Regimental Ball is to be held at the Caxton Hall, Westminster, on Thursday, February 1st. Dancing from 8.30 p.m. to 2 a.m.

Institution and Lecture Notes.—Institution of Mechanical Engineers.—A paper on "Worm Contact" was read by Mr. R. A. Bruce on the 19th inst., in which some of the problems peculiar to worm gearing were discussed. After explaining the formation of the teeth of the wheel corresponding to a given worm, the author showed the effect of increasing the pitch or diminishing the diameter in distorting the teeth, and stated that workshop methods were better and cheaper than drawing-office methods in arriving at the correct configuration of the teeth. Proceeding to deal with the nature of the contact obtained, the author showed that the contact path depended solely upon the shape of the rack tooth (to which the axial section of the worm is equivalent), and discussed the matter in detail with the aid of numerous diagrams. The area of physical contact between the working faces was shown to vary as the pitch diameter of the worm and the square root of the diameter of the wheel. By keeping the ratio of the height to the thickness of the teeth as large as practicable, the greatest possible number of teeth are enabled to operate simultaneously, but the teeth should be pitched finely to avoid interference. The worm should have the greatest possible ratio of pitch to diameter.

Royal Society.—The following papers were down for reading last evening:—

Prof. A. Gray, F.R.S., "Note on Heusler's Magnetic Alloy of Manganese, Aluminium and Copper."

W. Makower, "On the Effect of High Temperature on Radium Emanation." Communicated by Prof. A. Schuster, F.R.S.

Dr. M. Wilderman, "Galvanic Cells produced by the Action of Light. The Chemical Statics and Dynamics of Reversible and Irreversible Systems under the Influence of Light." Second communication. Communicated by Dr. L. Mond, F.R.S.

T. H. Havelock, "Artificial Double Refraction due to Æolotropic Distribution, with Application to Colloidal Solution and Magnetic Fields." Communicated by Prof. J. Larmor, Sec. R.S.

Dr. P. E. Shaw, "An Electrical Measuring Machine for Engineering Gauges and other Bodies." Communicated by Prof. J. H. Poynting, F.R.S.

Prof. A. G. Greenhill, F.R.S., "The Elliptic Integral in Electro-magnetic Theory."

Prof. W. Burnside, F.R.S., "On the Simple Group of Order 25,920."

Coventry Engineering Society.—Mr. R. B. Hodgson on Friday last read a paper on "The Hardening and Tempering of Steel," dealing with the obtaining, by means of an electric furnace and other appliances, of an actual heating curve of steel so as to find the recalescence points. He said a curve for any given grade of steel might be obtained by means of an electric furnace, a resistance pyrometer and a Callendar recorder. Describing the electrical resistance furnace, he said the heat was developed in a thin strip of platinum foil, which formed a close winding upon the outside of the porcelain cylinder of 1½ in. internal diameter. The platinum foil on the outside of the cylinder was lagged with very thick asbestos, so that when the ends were plugged with asbestos there was an extremely small loss of heat, consequently it required but a very small power consumption to maintain a high temperature within the porcelain tube. The furnace was designed for a maximum temperature of 1,400° C. (2,552° F.), and the maximum power was about 3,000 watts when working the furnace up to any desired temperature within its capacity. The electrical pyrometer used in connection with the apparatus for recalescence curves was of special type, the difference being in the construction of the head. On the outside was a removable steel sheath to protect the internal parts from the direct action of the furnace. Inside the steel sheath was a porcelain tube which contained the platinum leads, and at the bottom end of these leads was wound the platinum coil. The remaining portion of the recalescence apparatus was the Callendar electric recorder, with which a continuous record was obtained.

I.E.E. (Dublin Section).—The January meeting of this section was held on the 18th inst., Mr. P. S. Sheardown presiding. Mr. J. Ritchie, Edinburgh, read a paper on "Electric Cranes," in which he demonstrated the great economy of the electrically-driven crane over the steam-driven one, where the power could be obtained at a reasonable motor rate. The cost at Edinburgh came out at a quarter of the cost of the fuel of the steam crane doing equal duty. The electric crane was able to get through more work in the day than a steam crane of the same power. The paper dealt with the various types of electric cranes in use, and also described the telpher system used to carry the material for the construction of the railway bridge across the river at the Victoria Falls, at a height of 400 ft. above the river. The lecture was illustrated by limelight views.

Royal Institution.—On Friday last Prof. J. J. Thomson gave a lecture on "Some Applications of the Theory of the Electric Discharge to Spectroscopy."

Birmingham and District Club.—Mr. J. A. Jeckell, of Coventry, delivered his presidential address on Saturday, 13th inst.

Institute of Marine Engineers.—On the 15th inst. Mr. A. E. Battle gave a lecture on "Fluid Waves," illustrated with experiments. Dealing first with the waves of the sea, the lecturer led up to waves of sound and light, and so to electricity and its manifestations, including wireless telegraphy and wireless lamps (vacuum tubes).

Mr. Charles Bright, F.R.S.E., gave a lecture at the Brighton Technical College last Friday on behalf of the Navy League, the subject being "Submarine Telegraphy."

In Pollokshields Public Hall on 19th inst., Mr. James Dalrymple, Corporation tramways manager at Glasgow, delivered a lecture on "Tramways in Glasgow and Elsewhere."

Electric Lighting in the City.—Our readers are not likely to have forgotten the gas lighting experiments in the City, but it is as well to mention them when noting from the *Times* of yesterday that:—"The City of London Electric Lighting Co. has approached the Public Health Department of the City with a proposal to carry out, at their own cost, a demonstration showing the superiority of the most modern system of street lighting by electricity. The experiment will, it is proposed, be carried out in Newgate Street, Holborn, New Bridge Street, and Farringdon Street."

Now we shall see what we shall see!

The Electrical Trades Benevolent Institution.—In our issue of December 15th last we announced the establishment of the Electrical Trades Benevolent Fund by the National Electrical Manufacturers' Association, and mentioned the constitution of the Committee, giving particulars of donations that had been promised toward this very worthy object. In a later issue, December 29th (p. 1061), we published an abstract of the rules, from which our readers could understand the lines upon which the Fund was to be worked, and whom it was intended to benefit thereby. We have now received copies of the complete rules in final form as they are ready for circulation, and we take this opportunity of once more bringing the matter before employers and employés connected with the electrical trades. We would suggest that they should apply to Mr. W. Davenport, at the offices of the Manufacturers' Association, Ridler Place, Holland Street, Blackfriars, S.E., for copies of the rules, so that they may give the matter very careful consideration with a view to seeing whether they will not find it worth their while to be donors or subscribers. There must also be many gentlemen of eminence in connection with the electrical trade and profession who are able and willing generously to benefit their less fortunate fellows through the medium of such a fund.

Announcing Election Results.—Through the co-operation of the Hull T.C. Property Committee, the borough electrical engineer, the municipal telephone department and the N.T. Co., the proprietors of the *Eastern Morning News* and *Hull Daily News* were enabled to project the results of the elections on a screen erected on the open space in front of the City Hall.

Fatality.—A young electrical engineer, aged 21, and named James Graham, recently met with a fatal accident at the Argyll Motor Works.

Will.—The will of Mr. G. A. Grindle, who was drowned in the wreck of the *Hilda*, has been proved, the personalty being sworn at £6,062.

American Blizzard.—A Reuter Chicago dispatch states that owing to a severe snowstorm nearly all the telegraph wires are down, and the service on the elevated electric railway is about to be suspended, while the cable trams are only being worked with the greatest difficulty.

Kent Collieries, Limited.—At a meeting to be held to-day, a resolution will be submitted approving the Bill proposed to be introduced in Parliament, intituled "A Bill for empowering the Kent Collieries, Ltd., to supply electrical energy, and for other purposes." The directors have placed a contract for a permanent electrical installation with Messrs. Scott & Mountain, Ltd. The plant, in addition to being used for dealing with the water in the tubbing and sinking of No. 3 shaft, will also be required for general colliery purposes, including hauling and ventilation. Under the terms of the contract delivery of the plant should be completed by the end of March.

Appointments Vacant.—The Brighton T.C. has decided to appoint for six months a canvasser to solicit customers for current, at a salary not exceeding 50s. per week; fitter for Stockton-on-Tees electricity works (40s.); tramways accountant for Gloucester Corporation (50s.); shift engineer for Norwich Corporation (35s.).

The Electrical Engineers' Ball.—For the third year in succession the Electrical Engineers' Ball, held at the Hotel Cecil on Friday evening last, has added to the gaiety of nations. The attendance fell a little short of last year's record, but, on the whole, the function was, perhaps, more enjoyable. Dancing was kept up with great vigour until the witching hour of night, when the company sat down to a most enjoyable supper, the seating difficulty, which had on previous occasions led to some confusion, being completely eliminated by the arrangements made beforehand by the supper stewards. Within an hour the Muse of Dancing again held sway, and the proceedings did not terminate until an exhausted individual declared he had distinctly heard the clock strike one several times.

The hon. secretaries, treasurer and committee may be heartily congratulated on the very successful result of their whole-hearted labours, and we think that the universal wish of those present was for many happy returns of the day.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—Mr. C. F. Whiting was presented with a cigarette holder, suitably inscribed, by the members of the engineering staff of the Wakefield and District Light Railway Co. on his departure to take up a position on the staff of the Electricity Department of the Brighton Corporation. Mr. C. E. Davies, the resident engineer, made the presentation on behalf of the staff.

The Stoke Newington B.C. has increased the salary of Mr. S. Hann, electrical assistant.

The Southend-on-Sea T.C. has received 325 applications for the post of charge engineer at the Electricity Works.

Mr. Herbert Broadbent, chief engineer of the Perth Gas and Electricity Co., Western Australia, is in this country to purchase additional electrical plant. His headquarters are at the Grand Hotel, London, where all communications should be addressed.

The Dartford U.D.C. has appointed Mr. R. Jones as chief assistant engineer.

On 10th inst. the Harrow Electric Light and Power Co., Ltd., presented Mr. E. Rowley Hill, the engineer and manager, with a silver cigar cabinet on his leaving to take up the appointment of engineer and manager to the Reading Supply Co. The presentation was made at a works' dinner at which Mr. J. N. Stuart (chairman of the company) presided.

The Gloucester T.C. has been recommended by the Electricity Committee to appoint Mr. G. R. White as electrical engineer.

The Huddersfield T.C. has granted the following increases of salary:—Tramways department, Mr. J. C. Whiteley, chief assistant, from £160 to £170; Mr. H. Booth, chief cashier, from £140 to £150; Mr. Frank Smith, station engineer, from £90 to £100; Mr. Arthur Hollingworth and Mr. Harry Baron, station engineers, from £100 to £105; electricity works, Mr. E. Lunn, electrician-in-charge, from £117 to £123 10s.; Mr. H. P. Wadsworth, electrician-in-charge, from £91 to £97 10s.; Mr. A. V. Anderson, electrician-in-charge, from £78 to £84 10s.; Mr. Cyril E. Shaw, meter tester, from £52 to £54 10s. Huddersfield municipal generosity to its staff would be hard to beat!

The Ilford U.D.C. electricity department's first dinner was held at the Angel Hotel, Ilford, on Thursday, 18th inst. Mr. Arthur H. Shaw, the chief electrical engineer, presided over about 50 of the staff. A most enjoyable evening was spent.

The Rotherham Electricity Department staff held their first social gathering on Thursday last week, Mr. E. Cross, the engineer, presiding. About 40 sat down to supper, and a good programme of toasts and music followed.

Tramway Officials.—The Southend-on-Sea T.C. has appointed Mr. J. Dobson as day car-shed foreman, and Mr. W. Ansell as night car-shed foreman, in connection with the tramways.

Mr. A. A. Blackburn, A.M.I.E.E., the car works superintendent of the Belfast City Tramways (late of Manchester Corporation Tramways), was presented by the Lord Mayor with a gold medal in recognition of the assistance he had given at the inauguration of the electric tramways on November 29th last. The medal, which is of beautiful design, was specially manufactured for Sir Daniel by Messrs. Gibson & Co., Ltd., Belfast, and bears on one side the Belfast Coat of Arms, and on the other the following inscription:—"Presented to Mr. A. A. Blackburn, E.E., by the Lord Mayor (the Right Hon. Sir Daniel Dixon, Bart., D.L.), on the occasion of the inauguration of the Belfast Electric Tramways, November 29th, 1905. The Lord Mayor made the presentation in an appropriate speech, warmly congratulating Mr. Blackburn on his work, and Mr. Blackburn suitably responded.

According to the *Penang Gazette*, Mr. O. V. Thomas, of Westbury-on-Trym, was married on 28th inst., at Penang, to a Japanese lady, the only daughter of Yezo Sakaguchi, of Kumamoto, Japan. Mr. Thomas is the electrical engineer, under whose supervision the electric lighting and tramway schemes for the Penang Municipality have been carried out.

Early on Sunday morning, 21st inst., a large number of the Preston tramway staff and employés assembled at the tramway depôt in Holmrook Road for the purpose of making a presentation to Mr. Walter H. Tittensor, who is leaving Preston to take up an appointment in Glasgow. Mr. Tittensor was the recipient of some photographic and scientific apparatus, and of a handsome music cabinet for Mrs. Tittensor. Mr. Joseph F. Simpson, who is succeeding Mr. Tittensor in Preston, presided, and several speeches were made by those present, Mr. Tittensor acknowledging on behalf of Mrs. Tittensor and himself.

The employés of the Merthyr Electric Traction and Lighting Co., Ltd., held their annual dinner at the Tiger Hotel on January 11th, and presented Mr. A. J. L. Plunket, who is leaving the company's service, with a liquor cabinet and a smoker's cabinet, as a token of goodwill. Mr. Simons occupied the chair. The presentation was made by Mr. McCulloch, who conveyed the good wishes of all the employés, and was supported by Mr. Cousins, Mr. Madge and others. Mr. Plunket, in replying, introduced the new manager, Mr. Charlton. An enjoyable evening was spent.

General.—The staff of the Electrical Department of the North Staffordshire Railway Co. celebrated their ninth annual reunion with a dinner at the Red Lion Hotel, Stoke-on-Trent, on 18th inst. Mr. Andrew F. Rock, the telegraph superintendent, took the chair, and was supported by Messrs. Colin Roberts and H. A. Lewis as vice-chairmen; Mr. G. H. Jelfs (managing director, Messrs. Tyer and Co., London), Mr. J. Sinnott (G.P.O., London), Mr. A. E. Ruddock (National Telephone Co.), Mr. Arthur G. Dean (L. and N.W., Stockport), Mr. Blake (Chatterley), Mr. Henchy (Stoke), Mr. Dewsberry (Pipe Gate), Mr. Wain (Uttoxeter), and representatives from Uttoxeter, Tutbury, Leek, Harecastle, &c.

Mr. A. D. Crowther, of the Midland Railway Electrical Department, who is leaving Derby to take up an appointment at Umtali, South Africa, has been presented by the staff of the department with a silver-plated five-chambered revolver, a book on electrical engineering, and a stock of tobacco and cigarettes.

The Liverpool Electric Power and Lighting Committee have resolved to recommend the appointment of Mr. Alfred George Smith, assistant lighting engineer, as gas inspector and superintendent of street lighting, at a salary of £400 a year. The appointment of his successor remains under consideration.

At a social evening in the Bewick Hall, Gateshead, Mr. W. J. Charlton, late secretary of the County of Durham Electrical Power Distribution Co., Ltd., and the Gateshead District Tramways Co., was presented by the general manager of the Gateshead Tramways with a set of Venetian vases, a diamond ring and a pipe, on behalf of his colleagues on the staff and of the employés. Mr. Charlton is leaving the district to take up important work in connection with the development of electric light and power schemes in Cumberland.

On 23rd inst., at the Rose and Crown, Marylebone, Mr. Smith, chief engineer of the St. Helens Cable Co.'s Marylebone contract, was presented by the employés with a dressing case and hand bag as a mark of esteem, as he is leaving the firm. Mr. Stevenson, contract manager of the company, and the engineers of the contract, were present at a long and enjoyable evening.

The *Times* says that Captain J. J. F. O'Shaughnessy, Electrical Engineer Volunteers, who served through the South African war, has been appointed a superintendent of telegraph construction in Southern Nigeria.

The Ealing Electricity Supply Committee has appointed Mr. Stowell as collector from April 1st next, at £150, rising to £200.

Obituary.—A Liverpool paper reports an inquest held into the death of Mr. Francis Alexander Taylor, 48, an electrical engineer, who had been employed abroad by the Eastern Telegraph Co. It appears that in February last he had a nervous breakdown while on his way to the East, and on returning to Liverpool in July he entered a private asylum. On Saturday morning he was found lying on his bedroom floor with a bullet wound through his head and a revolver clasped in his right hand. A verdict of "Suicide during temporary insanity" was returned. There was no evidence to show how the revolver came into his possession, but he was allowed full liberty at the asylum, and was unattended.

NEW COMPANIES REGISTERED.

Lancashire Electric Supply Co., Ltd. (87,265).—This company was registered on June 18th, with a capital of £5,000 in £1 shares, to acquire the business carried on by the Lancashire Electric and General Supply Co., at Blackfriars, Manchester, and to carry on the business of manufacturers of electric appliances, fittings, machinery and tools, &c. The first subscribers (each with one share) are:—W. Dods, West Hill, Oldham, machinist; J. Prestwich, Busk Mills, Oldham, cotton spinner; H. D. Barker, 5, Etruria Street, Longsight, engineer; A. N. Anderson, 6, Hall Grove, Rusholme, Manchester, engineer; G. Leach, 11, Foster Street, Oldham, clerk; J. Colliery, 4, Chapel Walks, Manchester, incorporated accountant; and F. W. Roberts, 37, Sussex Street, Broughton, Manchester, engineer. No initial public issue. The subscribers are to appoint the first directors; qualification, 250 shares; remuneration as fixed by the company. Registered office, 27A, Blackfriars Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

A.B.P. Accumulator Co., Ltd. (76,438).—This company's annual return was filed on January 6th, when 3,106 preference, and 14,000 ordinary shares had been taken up out of a nominal capital of £20,000 in 6,000 preference, and 14,000 ordinary shares of £1 each. £1 per share has been called up and paid on 3,106 preference, and 14,006 ordinary are considered as fully paid. Mortgages and charges: £17,500.

British Columbia Electric Co., Ltd. (51,953).—This company's annual return made up to October 30th, 1905, was filed on January 10th, 1906. The capital is £1,000,000 in £115,000 5 per cent. cumulative perpetual preference stock, £300,000 deferred ordinary stock, £300,000 preferred ordinary stock, £5,000 5 per cent. cumulative preference shares of £1 each, and 200,000 other shares of £1 each, of which all the perpetual preference, deferred ordinary and preferred ordinary stock have been taken up, exclusive of seven shares forfeited. £200,000 deferred ordinary stock is considered as fully paid, and £529,376 15s. has been received in cash, including premiums on stock and £1 15s. paid on forfeited shares. Mortgages and charges: £460,400.

ELECTRICITY AND TRAMWAY ACCOUNTS.

Newport Municipal Electricity Supply and Tramways.

We give herewith the returns of the Newport Corporation's electricity and tramway undertaking for the year ending March last. The output continues to make excellent headway, the last three years' figures being 690,867, 1,572,362 and 2,265,217 units sold respectively; the improving load factor of 17 per cent. due to tramways and a growing motor load, is a feature which would lead to more appreciable results were not two generating stations in operation.

The result of the year's working, after meeting financial charges, was a balance on the right side of £479.

The tramways undertaking during the year under notice was hardly running under regular conditions, owing to its incomplete state, and the earnings did not reach a satisfactory average. Luckily, the concern was aided by very reasonable working expenses, and the balance of profit sufficed to cover the financial charges, less some £595.

The prices charged were: Private lighting, 5½d. to 3d., and power, 2d to 1d. per unit (sliding scales); traction, 1½d. per unit; and public arcs, £16 per annum. The chief engineer and tramways manager is Mr. H. Collings Bishop.

GENERAL STATEMENT FOR YEAR ENDING MARCH 31ST, 1905.

Total capital expended	£221,167*
Number of units sold—	
Private lighting	721,918
Public lighting	169,460
Power	373,150
Traction	1,000,688
Total number of units sold	2,265,216
Equivalent No. of 8-c.p. lamps connected	90,390
H.P. of motors connected	60
Number of public lamps	76
Maximum load in KW.	1,546

* Includes £45,250 to be transferred to Tramways Capital Account by order of the B. of T.

REVENUE ACCOUNT, 1905.

Gross revenue	£24,149 = 2·56d. per unit.
Works, distribution and special costs (inc. public lighting)	£9,982 = 1·06d. ,,
Total working costs	£11,368 = 1·20d. ,,
Gross profit	£12,781 = 1·36d. ,,
Average price obtained per unit—	
Private lighting	4·2d.
Public lighting	2·52d.
Power	1·15d.
Traction	1·5d.

PROFIT STATEMENT, 1905.

Interest and sinking fund	£12,302
Balance on year's working	479
Gross profit	£12,781

TRAMWAYS RETURNS FOR YEAR ENDING MARCH 31ST, 1905.

Length of route	7¼ miles
Total length of track	14½ ,,
Average number of cars in use	32
Car-miles run	792,365
Passengers carried per annum	6,421,773
Capital expended to date	£187,369*
Traffic receipts	£27,051
Total receipts	£27,851
Working expenses	£20,470
Gross profit	£7,381
Income per car-mile	8·46d.
Working expenses per car-mile	6·20d.
Interest and sinking fund per car-mile	2·41d.
Total expenses per car-mile	8·61d.
Profit or loss per car-mile	– ·15d.
Cost of energy per car-mile	1·88d.
Average fare per passenger	1·1d.
Revenue per mile of route	£3,841
Expenditure per mile of route	£2,823
Total units used	1,000,685
Units used per car-mile	1·26
Percentage of working expenses to receipts	73·4%

PROFIT STATEMENT:—

Interest and sinking fund (less credit bank interest)	£7,976
Deficit on year's working	£595

CITY NOTES.

Eastern Telegraph Co.

THE half-yearly meeting was held on Wednesday, at Electra House, Sir J. Wolfe Barry in the chair.

The CHAIRMAN, in proposing the adoption of the report, after referring with regret to the death of Sir Henry Fischer, one of the directors, said that the accounts showed no variations of an abnormal nature. As there was an increase of about £17,000 in the balance available, after providing for all expenses and fixed charges, he thought the result of the working for the half-year might be considered satisfactory. The gross revenue amounted, in round figures, to £607,700, as compared with, for the half-year to September, 1904, £589,400, or an increase of £18,300. This increase mainly arose from traffic with Egypt, Turkey, Greece, Spain, Portugal and the Red Sea ports. With regard to the Egyptian traffic, however, it must be borne in mind that, in accordance with the arrangement referred to in the last report, a considerable reduction in the tariff became operative from August 1st last. There were, therefore, only two out of the six months' accounts which were affected by this reduced rate. Although there had been an increase in the number of words carried to and from Egypt since August 1st, when the rate was reduced about 30 per cent., there had been, as they anticipated, a diminution of receipts from that date. They hoped, however, that this loss would gradually disappear as the business of that resourceful country expanded under its present beneficial management and control. Several other branches of traffic showed an improvement, while others had produced less revenue, the most important falling off taking place in the receipts from traffic with India, Aden, and South Africa. The decrease in the receipts from Indian traffic was partly caused by the reduction in the tariff from 2s. 6d. to 2s. per word, which came into force on August 1st last, in accordance with their agreement with the Secretary of State for India, under which a standard revenue was guaranteed. It was noteworthy that, notwithstanding this reduced rate, the actual number of words transmitted also showed a decrease. They fully anticipated that the reduction in the Indian rate would result in a loss of revenue for some time to come, but they hardly expected that there would be an actual falling off in the number of words transmitted, but such had been the case and similar results were observable when other reductions had been made, notably in Australia. Those facts pointed to the conclusion that the principal factor in stimulating the growth of telegraphic traffic, apart from financial reasons affecting the trade of various countries, was efficiency, both in speed and accuracy, and to this end they were constantly striving. They looked forward to being recouped for the present loss of revenue resulting from the reduction of the Indian tariff, by the gradual development of trade and the increasing prosperity of the Indian Empire, but the recoupment would not, he thought, be in leaps and bounds. The decrease in the traffic between Aden and Great Britain was caused partly by the reduction of tariffs, but principally through the cessation of military operations in Somaliland. The total expenses for the half-year, exclusive of income-tax payable in England, and interest on loan and debentures, amounted to £231,200, as against, for the corresponding period of 1904, £220,100, or an increase of £11,100. The expenses in London were £935 less, while the working expenses at stations are £3,300 more than in the corresponding half-year. The items of expenditure must necessarily vary each half-year, some showing increases and some decreases. The principal increases on this occasion were in salaries and wages, expenses of land-lines, and their contribution to other companies for joint station expenses. The expenses attending maintenance of cables showed an increase of £6,500. Two of their

ships had received special overhaul this half-year, which, of course, very materially added to the expenses under this head; but as the charge for this special overhaul included the cost of and expenses incidental to new boilers, they had allocated £10,000 from the maintenance ships fund as a contribution to this exceptional expenditure. During the half-year they had been able to repay the balance of the loan they received from the Eastern and South African Telegraph Co., the charge for interest appearing in these accounts being about £1,500 against, for the corresponding period, £9,200, or a reduction of £7,700. Income-tax payable in England also shows a reduction to the extent of £3,200, while interest on 4 per cent. mortgage debenture stock had increased to the extent of about £1,100. These were the details of the principal increases and decreases in the expenditure, but if the whole of the expenses and other charges against revenue were summarised, it would be found that the net increase was only £1,400, whereas the gross revenue was about £18,300 more than in the corresponding period of 1904, the increase of net revenue being about £17,000. They might have noticed an item which appeared this half-year for the first time in the revenue account. He alluded to a charge of £1,205 for supplementary retiring allowances. When the Staff Pension Fund scheme was submitted to the shareholders some 14 years ago it was agreed that in the case of some of the older members of the staff the pension which would accrue to them on their retiring from the company's service, and which would, of course, depend upon the annual amount set aside by the company, and to a certain extent upon the amount contributed by the staff from their salaries, would be inadequate to provide a suitable allowance in all cases. It had, therefore, been found necessary from time to time to supplement, in special and deserving cases, the amount of retiring allowances due to these older members of the staff from the established funds, and he felt sure that the proprietors would approve of this being done. In continuance of the operations which had been fully explained at previous meetings, they had charged against the general reserve fund £140,000 in respect of the cables laid between 1899 and 1903, and the balance of this account now stood at £115,000, which would be entirely written off during the current half-year. The board had made a contribution of £105 to the Indian Earthquake Fund, and the associated companies had also contributed £250 to the Queen's Unemployed Fund. He felt sure the stockholders would approve of both those payments.

Sir J. Denison Pender seconded the resolution, and the report was adopted.

City of London Electric Lighting Co.

Mr. George Herring presided on Wednesday at Salisbury House over an extraordinary general meeting of the above company for the purpose of considering and, if thought fit, passing the following resolution:—

Resolved, that the company approves the Bill proposed to be introduced into Parliament, intituled "A Bill for conferring further powers on the City of London Electric Lighting Co., Ltd., and other companies and bodies with respect to the supply of electrical energy and for other purposes," subject to such additions, alterations and variations as Parliament may think fit to make therein.

Mr. Morris (solicitor) explained that the object of the Bill was to confer upon the company further powers with regard to the supply of electric energy. By Clause 3 power was taken to give a supply of energy within the area of supply to any railway, tramway, canal, or navigation notwithstanding that the energy so supplied may be used outside the company's area. The clause also governed the supply to premises partly within and partly without the company's area. Clause 4 enabled an exchange of energy in bulk by agreement between the company and any authorised undertaker whose area of supply adjoined that of the company, and also in the Newington area, which formed part of the Borough of Southwark, but did not actually adjoin the company's area of supply. Clause 6 empowered the necessary laying of cables if the other objects were allowed, and Clause 6 authorised the use of the Bankside station for the purpose of supplying the energy.

The Chairman, in moving the resolution, said it would be understood that the company were not asking for an extension of area.

Mr. F. W. Reynolds seconded the resolution, which was carried unanimously.

Direct United States Cable Co.

The directors' report for the six months ended December 31st, 1905, to be presented at the meeting on 30th inst, shows that the half-year's revenue, after deducting out-payments, amounted to £56,353, as compared with £51,030 for the corresponding period of 1904, showing a difference of £5,323 in favour of the half-year under review. The working and other expenses for the same period, including income-tax, amounted to £23,299, leaving a balance of £33,054 as the net profit, making with £2,526 brought forward from the previous half-year a total of £35,580. For the corresponding period of 1904 the working expenses and other payments amounted to £22,108. Interim dividends of 3s. per share for the quarter ended September 30th, 1905 (paid October 26th, 1905), and of 3s. 6d. per share for the quarter ended December 31st, 1905, payable January 31st, 1906, together amounting to £19,731, have been declared, and after setting aside £10,000 to the reserve fund account, the balance of £5,849 on the revenue account has been carried forward. The reserve fund account, after being credited with interest on the investments and amounts set aside from revenue, now amounts to £500,701, taking the investments at cost price.

Anglo-American Telegraph Co.—The directors have resolved after placing the sum of £5,000 to the credit of the renewal fund for the half-year to recommend, at the meeting on February 2nd, the following dividends for the year ended December 31st: A balance of £1 1s. per cent. upon the ordinary consolidated stock; a balance dividend of £1 12s. per cent. upon the preferred stock; and a first and final dividend of 10s. per cent. upon the deferred stock, all payable on February 3rd, less income-tax. After paying the foregoing dividends there will be a balance of about £846 to be carried forward. The above dividends, together with those already paid, will amount to £3 5s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and 10s. per cent. on the deferred stock for the year 1905. The total dividends for 1904 were £2 15s. per cent. on the ordinary, and £5 10s. per cent. on the preferred, leaving £3,194 to be carried forward.

South London Electric Supply Corporation.—The company reports having sold during the quarter ended Christmas last, 2,757,087 units, realising £21,725. The figures for the corresponding quarter in 1904 were 2,546,868 units, realising £21,760.

Chloride Electrical Storage Co.—The company have paid off their £20,000 first mortgage debentures as at the end of 1905. The company have now no debentures of any kind whatever.

Prospectuses.—*The Tenom (Borneo) Rubber Co., Ltd.*—This company, which was formed for the purpose of acquiring from Mr. Frank Bost, Glasgow, a concession granted to him by the British North Borneo Co. of 10,000 acres, with a view to the cultivation of Para rubber, has been offering an issue of 60,000 ordinary shares and 1,000 deferred shares. A dividend of 4 per cent. per annum on the ordinary shares is unconditionally guaranteed for the first six years by the British North Borneo Co.

Harper Electric Piano Co.—From the financial papers we gather that a prospectus has been in circulation lately offering 10,000 10 per cent. cumulative preference shares for subscription. The prospectus has been severely handled by our aforesaid contemporaries.

The Malacca Rubber Plantations, Ltd.—This company is offering 95,000 preference shares of £1 each for subscription. The shares are 7½ per cent. participating cumulative shares. The company is to carry on the business of rubber planters, and to acquire the Bukit Asahan Estate, in Malacca.

North Metropolitan Tramways Co.—Pending the issue of the accounts for the nine months ended March 31st next (when the company will cease working the tramways now leased by them within the County of London), the directors have considered an approximate statement of the accounts for the half-year ended December 31st last, and recommend an interim dividend at the rate of 3½ per cent. per annum for the six months.

St. James's and Pall Mall Electric Light Co.—The directors recommend a dividend for the half-year ending December 31st of 7s. 6d. per share on the ordinary shares, making, with the interim dividend paid on August 1st last, a total distribution of 12½ per cent. for the year. This compares with 14½ per cent. for 1904 and a number of previous years.

Great Northern and City Railway Co.—The half-yearly meeting is to be held on February 8th.

Charing Cross, West End and City Electricity Supply Co.—An extraordinary general meeting will be held at 60, St. Martin's Lane, W.C., on Wednesday, 31st inst., to consider and approve a Bill to confer further powers upon the Charing Cross, West End and City Electricity Supply Co., Ltd. (Power Supply).

City and South London Railway Co.—The accounts for the half-year ended December 31st, 1905, show a balance, after providing for debenture interest, payment of dividend on the preference stocks, and transferring to renewal fund £1,500, sufficient to allow of a dividend on the consolidated ordinary stock at the rate of 1⅜ per cent. per annum, carrying forward £1,366. The dividend for the corresponding period last year was at the rate of 1⅜ per cent. per annum and the sum carried forward £1,449.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

British Aluminium Co., Ltd.—£300,000 5½ per cent. Loch Leven Debentures of £100 each, Nos. 1 to 3,000 (registered).

The Committee has appointed a special settling day as under:—

Wednesday, January 31st.—National Telephone Co., Ltd.—90,000 ordinary shares of £5 each, fully paid, Nos. 800,001 to 890,000.

and has ordered the under-mentioned securities to be quoted in the Official List:—

Commercial Cable Co.—Further issue of £164,824 sterling 500-year 4 per cent. debenture stock (redeemable).

Newcastle and District Electric Lighting Co., Ltd.—20,000 shares of £10 each, £9 paid, Nos. 1 to 20,000; and 10,000 shares of £10 each, £5 paid, Nos. 20,001 to 30,000.

Liverpool Overhead Railway Co.—The accounts for the past half-year show an available balance of £7,460. The directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares which will absorb £3,676, and carry forward a balance of £3,784. For the 1904 half, there was a dividend at the rate of 1¼ per cent. per annum on the ordinary stock, and £3,743 was carried forward.

Central London Railway Co.—The directors have declared a dividend at the rate of 4 per cent. per annum for the past half-year on the ordinary and preferred stocks, also at the rate of 4 per cent. per annum for the whole year on the deferred stock, adding £10,000 to the reserve, and carrying forward £25,394. For 1904 the dividends were the same, but £30,000 was carried to reserve, and £22,000 was carried forward.

MARKET QUOTATIONS.

Wednesday, January 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	10½d.	..
a ,, (50 %)	per gal.	10d.	..
a Copper Sulphate	per ton	£23 15	..
a Lead, Nitrate	per ton	£25	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a Potassium Bichromate, in casks	per lb.	8d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	190/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Crystals	per ton	£8 5	..
a Sodium Bichromate, casks	per lb.	2½d.	..
a ,, Cyanide	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£160	£10 inc.
b ,, Wire, in ton lots	per ton	£191	£14 inc.
b ,, Sheet, in ton lots	per ton	£177	£2 inc.
b Babbitt's metal ingots	per ton	£43 to £140	..
c Brass (rolled metal 2" to 12") basis	per lb.	9d.	½d. inc.
c ,, Tube (brazed)	per lb.	10¾d.	..
c ,, ,, (solid drawn)	per lb.	9¾d.	..
c ,, Wire, basis	per lb.	9d.	..
c Copper Tubes (brazed)	per lb.	11¾d.	..
c ,, ,, (solid drawn)	per lb.	11¾d.	..
g Copper Bars (best selected)	per ton	£93	£2 dec.
g Copper Sheet	per ton	£93	£2 dec.
g ,, Rod	per ton	£93	£2 dec.
e ,, (Electrolytic) Bars	per ton	£92	..
e ,, ,, Sheets	per ton	£104	..
e ,, ,, Rod	per ton	£95	..
e ,, ,, H.C. Wire	per lb.	11d.	..
f Ebonite Rod	per lb.	8/3	..
f ,, Sheet	per lb.	3/-	..
n German Silver Wire	per lb.	1/7	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	5/2½ to 5/4	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	53/2	1/5½ dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£17 5 to £17 7 6	inc.
g ,, ,, Sheet	per ton	£19 12 6	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£7 5	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/3	..
p ,, rolled bars & rods	per lb.	1/1½ to 1/3	..
p ,, ,, strip & sheet	per lb.	1/4	..
o Platinum	per oz.	85/6	..
e Silicium Bronze Wire	per lb.	11d. to 11½d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£166 10 to £167 10	..
n ,, Wire, Nos. 1 to 16	per lb.	1/10½	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£46 to £70	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5¾d.	..
j ,, 3 ply 10 lbs. Russian	per lb.	4½d.	..
j ,, 10 lbs. Russian, single	per lb.	4¾d.	..
j ,, 180 lbs. Jute rove	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£22 5	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
j Walter H. Hindley & Co., Ltd.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Chair of Electrical Engineering at Armstrong College.—The Council of the Armstrong College, Newcastle, has just resolved to establish a Chair of Electrical Engineering, and has voted a sum of £2,600 towards forming new electrical engineering laboratories. It has been decided to offer yearly for competition two scholarships, worth £125 each, tenable by graduates at the College, on the condition that they spend their time in the prosecution of definite research.

STOCKS AND SHARES.

Wednesday afternoon.

THE higher rises the tide of Liberal successes, the lower sinks the range of electrical supply values. Had the defeated Protectionist candidates only hedged their chances by selling a bear of electric shares a fortnight before the polling-day, how consoled would they now be feeling! In all seriousness, however, the drop in prices has proceeded to a point which some of the cautious authorities consider cheap. On the other hand, equally sound experts—and amongst them some of the practical, as opposed to theoretical, financiers—think that prices have further to recede before turning the corner, and to this latter view the appearance of the market causes us to incline. And the dividends are not at all likely to assist prices this time.

Unfortunately, the share list is, more than ever, no accurate criterion to the actual state of the market, for would-be sellers discover in some cases that they are unable to obtain the lower of the two prices for any but a small lot of shares. Charing Cross Ordinary have been put down nominally ½, but Westminsters lost as much as 15s., the shares being a peculiarly dull market. Kensingtons dropped ¼, and so did Metropolitans, while falls of 10s. left Edmundson's Preference at 5¼, and St. James's Ordinary at 12. The dividend on the latter has fallen to 7s. 6d., which makes a reduction of 2 per cent. for the whole year as compared with the distributions from 1897 until now. Other minor changes have taken place, but there is no need to pile up the recital of losses which may be studied overleaf. The only bright spot in the share list is ½ rise in County of London Preference, while Midland Electric Debenture and Folkestone Debenture are a point better. So far from the approaching dividends being a "bull" point for the market, they are, as already mentioned, estimated in sombre tints. Thus and thus do Stock Exchange markets pendulum; if precedent were the only point for consideration we should vote for a sharp and early reaction upward in electric prices.

Upon the dividend at the rate of 1⅞ per cent. per annum for the half-year, City and South London Ordinary failed to recover its earlier lost point, which reduced the price to 44. The rate is the same as that declared a year ago, and makes 1⅞ per cent. for 1905, so that the yield at present works out to 4¼ per cent. on the money. In 1902 the dividend for the full twelvemonth came to 3¼ per cent.; in 1903 it was 2⅜ per cent., and in 1904 2⅛ per cent., so that the distribution has steadily retrograded during the last few years. The new chairman will, it is devoutly hoped, be enabled to put a more cheerful complexion upon the current year's accounts. Central London stocks are steady, the Preferred advancing to 105, but the two Undergrounds weakened, Metropolitan to 86½ and Districts to 36. The former went dull on the report, showing that a considerable draft has been made upon the reserve fund to pay even the reduced dividend. East London stock remains at 5¼, and Lord Claud Hamilton had nothing very exhilarating to say at the meeting on Thursday. He compared the company to a little Benjamin under the charge of six big brothers, who kept the former on very short commons. What seems to be wanted is a seventh brother, who will play Joseph to the East London's Benjamin. It is interesting to notice that the Lancashire and Yorkshire Railway, which went boldly into electrification of part of its system, has increased its dividend at the rate of ½ per cent.

Amongst traction descriptions the feature is a drop of ¼, to 8¾, in British Electric Ordinary, and of ⅜, to 10¾, in the Preference shares. In the market the only reason advanced for the weakness is the public's disinclination to buy such shares at present. The Argentine varieties maintain their advancing tone, Anglo Preference being ½ better, and Belgrano "B" Preference ¼ up, the latter at 5½. Calcutta Trams, both old and new, rose ¼, although the Debenture stock at 105 have eased off a point. London United Tramway Preference and Debenture are both lower, with British Electric Tractions. The British Columbia quintet shows no change. A new issue of Rangoon Electric Tramway and Supply Debenture stock and Preference shares was met favourably. The Debenture stock has attractions.

Great excitement in the Telegraph department finds Anglo-American Deferred hoisted to 18½, a rise of 1 on the week. The 10s. dividend was 33 per cent. more than the market had looked for, but unless a substantial improvement occurs during the current year, the present price of Anglo "A" cannot be said to be justified upon its dividend return alone. Doubtless some other cause is at work for the heavy buying now in progress, but we must candidly admit inability to trace it, and the various rumours put forward to account for the jump are merely market explanations. The Preferred and Ordinary stocks have each risen in company with the Deferred. Eastern Telegraph Ordinary improved upon the issue of the report, while in the other direction there must be noted ½ fall in West India and Panama shares. National Telephone stocks are still on the up-grade, the Preferred and the 3½ per cent. Debenture being both ½ higher.

At 35, Telegraph Constructions put up a further 10s., and the Manufacturing group is better as a whole, with no particular variation in prices.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905. §	Closing Quotations Jan. 17th.	Closing Quotations Jan. 24th.	Business done week ended Jan. 24th, 1906. Highest	Lowest.	Rise + or Fall —
17,760	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	4 %	98½ —101½	98½—101½	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3⅞— 4¼	3⅞— 4¼	3 2/6	..	..
155,600‡	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	5 %	82 — 87	83 — 88	86¼	85¼	+1
702,600	Anglo-American Telegraph	Stock	60/6	61s.	2¾%	3½%	64 — 66	65 — 67	66	..	+1
3,148,700	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5¾%	6 %	112 —113	114 —115	114¼	113	+2
3,148,700	Do. do. do. Deferred	Stock	1/-	2s.	Nil	½%	17 — 17½	18 — 18½	18¾	18¼	+1
50,000	Anglo-Portuguese Tel., 5% Mort. Deb. Stock Red.	100	..	..	..	..	102 —104	102 —104	..	..	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅞— 8⅛xd	7⅞— 8⅛ xd	..	..	..
1,992,856‡	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	98 —100	97 — 99½	98	..	— ½
16,090	Cuba Telegraph	10	6¼%	10 %	5 %	5 %	8¼ — 9	8¼— 9	8¼	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %	17 — 18	17 — 18	17	..	..
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝— 3¾	3⅝— 3¾	..	..	..
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¼— 8½	8¼— 8½	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..
60,710‡	Direct United States Cable	20	3½%	3 %	3½%	3½%	14½— 15½	14½— 15½	15 1/8	15	..
70,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 ⅝%	146 —149 xd	148 —151	150	147	+2
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	91½— 93½xd	92 — 94	93⅝	92½	+ ⅜
1,848,772	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	107 —109	109 —109½	109¼	..	+1½
800,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	6 ⅝%	14½— 15 xd	14½— 15 xd	14⅝	14½	..
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 ⅝%	107 —109	107 —109	..	..	..
800,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101	..	..
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	101 —103	102¾	..	..
180,887	Globe Telegraph and Trust	10	£3	5½%	5⅝%	5 %	11½— 11¾	11½— 11⅝	11 7/8	11¾	— ⅛
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	14⅝— 14¾	14⅝— 14⅞	14 15/16	14 7/8	— ⅛
150,000	Great Northern Telegraph, of Copenhagen ..	10	12½%	15 %	24 %	..	87½ — 89½	87½ — 89½	..	..	..
42,800	{ Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. }	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	5 %	57 — 59	57 — 59	..	..	..
251,127	Marconi's Wireless Telegraph	1	..	..	..	..	1⅛— 1¼	1⅛— 1¼	..	..	..
73,689	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	4 %	..	⅞— 1	⅞— 1	..	..	..
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞— 1	⅞— 1	..	..	..
1,988,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 ⅝%	112½ —113¼	113 —114	113½	112⅝	+ ⅛
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 ⅝%	111 —112	110 —112	111½	110½	— ½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 ⅝%	13 — 15	13 — 15	14½	14½	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 ⅝%	11 — 13	11 — 13	12½	12½	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 ⅝%	5⅜— 5⅞	5⅜— 5⅞	5⅝	..	..
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	99 —101	99½—100½	100	..	..
1,688,593	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	104 —105	104 —106	104½	104	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6¼%	6¼%	6 %	1⅝— 1 7/8	1⅝— 1 7/8	27/6	..	..
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1½— 1⅝	1½— 1⅝	..	..	..
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	..	4 %	96 — 98	96 — 98	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
11,889‡	Reuter's	8	5 %	5 %	5 %	5 ⅝%	7½— 7¾	7½— 7¾	..	..	..
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	..	4½%	101 —104	101 —104	102	..	..
8,201	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	126 —129	125—128	..	..	—1
70,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7¼— 7½	7¼— 7½	..	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜— 5½	5⅜— 5½	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	110 —112	110 —112	110½	..	..
15,600‡	West African Telegraph, Shares	10	2 %	4 %	4½%	4 %	9¾— 10	9¾— 10	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅞— 1 1/16	⅞— 1 1/16	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	5 %	14½ — 14¾	14½ — 14¾	14⅝	14 3/16	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	5 %	100 —102	100 —102	103	..	..
563,380	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	103⅜	103	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	½	..	— ⅛
84,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	6 %	8¼— 8⅝	8¼— 8⅝	8⅝	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	6¾— 7⅛	6¾— 7⅛	..	..	..
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

170,000	Anglo-Argentine Trams, 260,008 to 430,007	5	..	..	8 %	6 ⅜%	8⅜— 8⅛	8⅜— 8⅞	8⅞	..	+1/16
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	..	5 %	5 %	5½%	5⅝— 6	5⅞— 6⅛	6	5⅝	+ ⅛
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	140 —143	140 —143	..	..	..
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	..	5 %	5 %	5 %	104 —106	104 —106	105	104½	..
800,000	Babcock & Wilcox, 1 to 580,000	1	..	17 %	20 %	16 ⅝%	3⅜— 4	3⅜— 4	77/6	75/-	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	..	6 %	6 %	6 %	1⅞— 1 15/16	1⅞— 2	..	..	+ ⅛
40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	3/6	5½— 6	5½— 6	..	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	3/-	5 — 5½	5 — 5½	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅜— 2⅝	2⅜— 2⅝	..	..	+ ⅛
300,000‡	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	98 —102	98 —102	99½	..	..
300,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	..	120 —123	120 —123	122½	121½	..
300,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	..	110 —113	110 —113	..	..	..
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	108 —111 xd	108 —111	109½	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	103 —105 %	103 —105%	..	..	..
290,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	100 —103 xd	101 —104 xd	..	..	+1
133,801	British Electric Traction	10	8 %	6 %	6 %	..	8⅜— 8⅞	8⅛— 8⅜	8⅜	8⅛	— ⅛
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	10⅝— 11⅛	10⅝— 11	11 1/16	10 15/16	— ⅛
1,415,429‡	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	119 —121	119 —121	119½	119	..
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	4½%	98 —100	98 —100	..	..	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 ⅜%	7 — 7⅛	7 — 7⅛	..	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 ⅜%	6 — 6⅛	6 — 6⅛	6 1/16	5 31/32	..
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	104½	..	..
212,900	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	..	4½%	4½%	4½%	98 —100	98 —100	..	..	..
400,000	{ British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 }	5	..	6 %	Nil	..	1⅜— 2⅛	1⅜— 2⅛	42/6	40/-	..
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	..	4 %	4 %	4 %	77 — 82	77 — 82	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 16/6	14/6 to 16/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1⅛— 1⅜	1⅛— 1⅜	28/9	..	..
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	99½	..	..
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	82 — 84	82 — 84	..	..	..
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	..	3⅜— 3⅝	3⅜— 3⅝	75/7½	76/3	..
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	..	5⅜— 6	5⅜— 6	6	..	..
27,500	Do. "B" do. 1 to 27,500	5	..	6 %	6 %	..	5 — 5⅛	5⅛— 5⅜	5 1/16	5 7/16	+ ⅛
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	105 —107	105 —107	..	..	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..
105,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	7 ⅝%	9½— 9¾	9½— 10	9 15/16	..	+1
32,610	Do. 105,001 to 137,610	5	..	..	..	3¾	8¾— 9	8⅞— 9⅛	..	..	+ ⅛
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4 %	4½%	105 —107	104 —106	..	..	— 1
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	10%	11 — 12	11 — 12	..	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5¾xd	..	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108 —110	108 —110	110	108½	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 ⅝%	⅞— 1⅛	⅞— 1⅛	22/-	..	..
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	..	1⅛— 1 3/16	1⅛— 1 3/16	..	..	..
230,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	97 —102	97 —102	..	..	..
1,939,698	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 ⅝%	95 — 97	95 — 97	96¼	95½	..
530,316	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 ⅝%	103 —105	104 —106	105	..	+1
530,316	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	86 — 89	86 — 89	..	..	..
1,499,000	City and South London Railway	Stock	3½%	2¾%	2¾%	1¾%	44 — 46	43 — 45	44¼	44	—1
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	..	1⅞— 2⅛	1⅞— 2⅛	..	..	..
100,000‡	{ Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red. }	..	5 %	5 %	5 %	5 %	95 — 98% xd	95 — 98	97⅞	97½	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 17th.	Closing Quotations Jan. 24th.	Business done week ended Jan. 24th, 1906.		Rise + or Fall−
		†	1902.	1903.	1904.	§1905.			Highest	Lowest.	
52,000	Dick, Kerr & Co., 1 to 52,000	£5	..	..	10 %	..	8½ — 9	8½ — 9	..	..	..
61,000	Do. do. 6 % Cum. Pref., 1 to 61,000	£5	..	6 %	6 %	6 %	5⅞ — 6¼	5⅞ — 6¼	..	..	..
294,150	Do. do. 4½ % Deb. Stock	£100	..	4½ %	4½ %	4½ %	104 —106	104 —106	..	..	..
60,000	Dublin United Trams. (1896), 1 to 60,000	£10	..	5½ %	6 %	6 %	13¾ — 14½	13¾ — 14½	14⅜	..	..
59,987	Do. 6 % Pref. between 1 and 60,000	£10	..	6 %	6 %	6 %	14⅜ — 15½	14⅜ — 15½	..	..	..
63,400	Do. 4 % Debs.	£100	..	4 %	4 %	4 %	99½ —100½	99 —101	..	..	..
300,000	Do. 3½ % "A" Debs.	£100	..	3½ %	3½ %	3½ %	98 — 99	98 —100	..	..	+ ⅛
300,000	Do. 3½ % "B" Deb. Stock	£100	..	3½ %	3½ %	3½ %	96 — 96½	96 — 98	..	..	+ ¾
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	£5	Nil	Nil	2½ %§	..	1⅜ — 1⅝	1⅜ — 1⅝	31/3	30/7½	..
17,139	Do. "A" shares, 01—017,139	£5	Nil	Nil	2½ %§	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..
844,023	Do. 4 % Deb. Stock Red.	£100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..
100,000	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	£100	5 %	5 %	5 %	5 %	92 — 97	92 — 97	..	..	..
112,100	Electric Construction 1 to 112,100	£2	6	4	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	£2	7	7	7 %	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4	4	4 %	4 %	90 — 93 xd	90 — 93	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	£10	5 %	5 %	5 %	..	9 — 9¼	9 — 9¼	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	96 —100	96 —100	..	..	..
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	£10	..	3 %	4 %	4 %§	5¼ — 5⅝	5⅜ — 5⅝	5⅜	..	..
96,000	Greenwood & Batley 7 % Cum. Pref.	£10	..	7 %	7 %	7 %	10⅜ — 11¼	10⅜ — 11¼	..	..	..
80,000	Do. do. 5 % Mort. Debs.	£100	..	5 %	5 %	5 %	102 —103	102 —103	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	£5	20 %	15 %	15 %	10 %§	12¼ — 12½	12¼ — 13⅛	13⅛	13⅛	..
200,000	Do. do. 4½ % Pref.	£5	4½ %	4½ %	4½ %	4½ %	5¼ — 5⅜	5¼ — 5⅜	5 1/16	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	.. — ..	.. — ..	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	£10	10 %	10 %	5 %	10 %	18½ — 19¼	18¾ — 19¼	18 3/16	18½	..
800,000	Do. do. 4% 1st Mort. Deb.	£100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	£10	1½ %	1⅜ %	1½ %	1½ %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..
10,000	† Do. do. Pref. £10 paid	£10	5 %	5 %	5 %	5 %	6½ — 7	6⅝ — 7	..	..	..
600,070	London United Trams (1901), 1 to 50,007	£10	..	8 %	6 %	4 %§	10 — 11	10 — 11	..	..	..
399,930	Do. do. 60,008 to 100,000 (£4 paid)	£10	..	8 %	6 %	4 %§	4 — 5	4 — 5	..	..	..
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	£10	..	5 %	5 %	5 %	9¼ — 10	9⅛ — 9⅝	..	..	— ⅛
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	£100	..	4 %	4 %	4 %	98 — 101	97 —100	..	..	—1
314,016	Metropolitan Electric Trams, Defd.	£1	Nil	Nil	Nil	..	3/32 — 3/16	3/32 — 3/16	..	..	..
500,000	Do. 5 % Cum. Pref.	£1	5 %	5 %	5 %	5 %	1 — 1 1/16	1 — 1 1/16	20/3	..	..
350,000	Do. 4½ % Deb. Stock Red.	£100	..	..	4½ %	4½ %	104—106	104 —106	105	..	..
20,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	£5	..	..	6 %	6 %	5 — 5¼	5 — 5¼	..	..	..
24,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	£10	..	5 %	5 %	..	8¾ — 9¼	8¾ — 9¼	..	..	..
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	£10	..	5 %	5 %	5 %	9⅝ — 10¼	9⅝ — 10¼	..	..	..
245,000	Do. 4½ % Deb. Stock	£100	..	4½ %	4½ %	4½ %	103 — 106	103 —106	..	..	..
37,350	Telegraph Construction and Maintenance	£12	20 %	20 %	15 %	10 %	33¾ — 35½	34 — 36	35	..	+ ½
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	£100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	98 — 99	98 — 99	100⅛	..	..
540,000	Waterloo & City Railway, Ord. Stock	£100	3½ %	3½ %	3½ %	3 %§	94 — 97	94 — 97	94	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	£5	8½ %	6 %§	..	..	2 — 2¼	2 — 2¼	48/9	45/-	..
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	£5	..	6 %	..	..	4 — 4¼	4 — 4¼	85/-	82/6	..
246,806	Do. 4 % 1st Mort. Deb. Stock	£100	..	4 %	4 %	4 %	82 — 87	82 — 87	85⅝	..	..

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	£5	..	5 %	5½%	4 %§	5¼ — 5⅝	5¼ — 5⅝	..	..	..
50,000	Do. do. 4½ % 1st. deb. stock	£100	..	4½ %	4½%	4½%	102 —105	102 —105	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	£5	8 %	10 %	10 %	9 %	8½ — 9¼	8½ — 9¼	8⅝	8½	..
10,623	Do. do. 7 % Cum. Pref.	£5	7 %	7 %	7 %	7 %	8½ — 9¼	8½ — 9¼	..	..	..
300,000	Central Electric Supply 4 % Guar. Deb. Stock	£100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..
80,000	Charing Cross and Strand Electricity Supply	£5	10 %	8 %	8 %	5 %§	6 — 6¼	5⅝ — 6¼	..	..	— ⅛
80,000	Do. do. do. 4½ % Cum. Pref.	£5	4½%	4½%	4½%	4½%	5¼ — 5⅝	5¼ — 5⅝	5⅛	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	£5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..
40,000	Do. do. 1903	£5	..	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..
420,000	Do. do. 4 % Deb. Stock Red.	£100	4 %	4 %	4 %	4 %	101 —103	101 —103	102⅜	..	..
44,486	Chelsea Electricity Supply, Ord.	£5	4½%	5½%	6 %	4½%§	5¼ — 5⅜	5 — 6	5⅜	5 1/16	..
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	108 —110	108 —110	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	£10	5 %	5 %	6 %	5 %	11 — 12	11 — 12	11⅛	11 1/16	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	£10	6 %	6 %	6 %	6 %	13½ — 14½	13½ — 14½	..	..	..
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —126	122 —126	..	..	..
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	£100	4½%	4½%	4½%	4½%	101 —103	100 —102	101½	..	—1
40,000	County of Durham Electrical Power, Ord.	£2	..	..	..	..	2 1/16 — 2 1/16	1 15/16 — 2 1/16	..	..	— 1/16
50,000	Do. do. do. 5 % Pref.	£5	..	..	..	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	— ⅛
40,000	County of London Electric Lighting, Ord. 1—40,000	£10	4 %	4 %	4½%	4 %§	8¾ — 9¼	8¾ — 9¼	9	8⅞	..
80,000	Do. do. 6 % Pref., 40,001—60,000	£10	6 %	6 %	6 %	6 %	12⅜ — 12¾	12⅛ — 13	13	12⅜	+ ⅛
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	110 —113	109 —112	110	..	—1
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..
80,000	Edmundson's Electric Corporation, Ord. Shares	£5	7 %	7 %	7 %	..	5 — 5⅛ xd	5 — 5⅛	5 1/16	5 1/16	..
80,000	Do. do. 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	5⅛ — 5⅜	5 — 5⅜	5⅜	5 3/16	— ⅛
320,000	Do. do. 4½ % 1st Mort Deb. Stk	£100	4½%	4½%	4½%	4½%	104 —106 xd	104 —106	105	104	..
10,000	Folkestone, 1 to 10,000	£5	..	5½%	5½%	4 %§	5¼ — 5⅜	5¼ — 5⅜	..	..	..
10,000	Do. 5 % Cum. Pref., 1 to 10,000	£5	..	..	..	5 %	5 — 5¼	5 — 5⅜	..	..	..
75,000	Do. 4½ % 1st. Deb. Stock	£100	..	4½%	4½%	4½%	101 —104	102 —105	..	..	+1
13,000	Hove, 1 to 13,000	£5	..	8½%	8½%	8 %	8¼ — 9¼	8¼ — 8⅝	..	..	— ⅛
10,000	Do. New (£5 10s. paid)	£3	..	8½%	8½%	8 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..
37,303	Do. 4 % Deb. Stock	£100	..	4 %	4 %	4 %	92 — 94	98 —101	..	..	..
7,300	Do. 4½ % Deb. Stock	£100	..	4½%	4½%	4½%	97 — 99	98 —101	..	..	+1½
21,000	Kensington and Knightsbridge Electric Ord.	£5	10 %	12½	12 %	10 %	10⅜ — 11⅛	10½ — 11⅛	10⅛	..	— ¼
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	£3	Nil	Nil	3 %	..	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..
60,000	Do. do. do. 6 % Pref.	£5	6 %	6 %	6 %	6 %	4½ — 5⅛	4½ — 5⅛	..	..	..
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..
200,000	Metropolitan Electric Supply, 1 to 100,000	£5	7½%	8½%	10 %	10 %§	9 — 10	8⅞ — 9¼	9⅛	9¼	— ⅛
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	£5	4½%	4½%	4½%	4½%	5¼ — 5⅜	5¼ — 5⅜	5 1/16	5 1/16	..
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —111	107 —111	..	..	..
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	95 — 97	95 — 97	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	£100	4½%	4½%	4½%	4½%	99 —101%	100 —102	101	100½	+1
57,009	Newcastle-on-Tyne, 1 to 57,009	£5	..	8 %	8 %	2½%§	8 — 8½	8 — 8½	..	..	..
17,991	Do. 57,010 to 75,000	£5	..	..	..	2/4½	8 — 8½	8 — 8½	..	..	..
57,009	Do. 5 % Pref., 1 to 57,009	£5	..	5%	5	5 %	6½ — 6¾	6½ — 6¾	..	..	..
17,991	Do. 57,010 to 75,000	£5	..	..	..	2/4½	6½ — 6¾	6½ — 6¾	..	..	..
10,852	Notting Hill Electric Lighting	£10	6 %	6 %	7 %	6 %	13½ — 14½	13⅜ — 14½	13⅜	..	..
64,000	Do. do. 4 % 1st Mort. Deb.	£100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..
18,500	Oxford, 1 to 96 and 407 to 18,810	£5	..	6½%	7 %	5 %§	6⅝ — 6¾	6⅝ — 6¾	..	..	..
50,000	Do. 4 % Deb. Stock	£100	..	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	£5	14½%	14½%	14½%	12½%	12 — 13	11½ — 12½	12⅜	11⅝	— ⅛
20,000	Do. do. 7 % Pref. 20,081 to 40,080	£5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	7½	..	..
150,000	Do. do. 3½ % Deb. Stock Red.	£100	3½%	3½%	3½%	3½%	97 — 99	97 — 99	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	£5	2½%	4 %	4 %	..	2 — 2½	2 — 2¼	46/3	..	..
50,000	Do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	£5	12½%	8 %	4 %	..	3 — 3½	3 — 3½	..	..	..
103,700	South Met. Elec. Lt. & Power Ord.	£1	Nil	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..
85,868	*(Late Blackheath and Greenwich Dist. E.L.Co.)* 7 % Pref.	£1	Nil	7 %	7 %	7 %	1⅝ — 1 1/16	1⅝ — 1 1/16	..	..	..
148,292	*(Late Blackheath and Greenwich Dist. E.L.Co.)* 4½ % 1st Deb. Stk.	£100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..
50,000	Urban Electric Supply, Ord.	£5	5 %	5 %	5 %	5 %	4⅜ — 4¾	4⅜ — 4¾	95/7½	92/6	..
80,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	5 %	5 — 5¼	5 — 5¼	5 3/16	5⅛	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	£100	..	..	4½%	4½%	105 —107	104 —106	..	..	—1
110,000	Westminster Electric Supply, Ord.	£5	12 %	13½%	14 %	13 %§	11½ — 12½	10½ — 11½	11⅝	10⅞	— ⅜
28,151	Do do. 4½ % Cum. Pref.	£5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5 5/16	5⅜	..

Shares not officially quoted :—Mackay Companies, ord., 64—64½. Pref. 76½—77½.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 4 per cent. (September 28th, 1905).

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1905.

The December electrical trade returns afford us some satisfaction from the fact that our electrical export business continues on the steady upward grade of the last four months; the value of electrical goods imported into this country is also somewhat above that of the previous month. Over the 11 months, during which our tabulated returns have appeared, the exports, varying in value from £80,000 to £138,000 per month, show considerably wider fluctuations than the imports, in which the monthly values varied from £101,000 to £140,000. The monthly averages in each case have been £112,000 and £119,000.

Turning to the December returns, our electrical exports reached £122,648 in value, or some £12,000 in excess of the November figures; electrical imports amounted to £135,002, or nearly £4,000 more than in the previous month, while the re-exports, at £8,754, were some £800 less than in November.

During the month our exports of cables and machinery remained most prominent, the latter reaching the high value of £49,000, while machinery imports rose to nearly £43,000.

On the whole, the past year's figures indicate a decline in the importation of electrical machinery into this country, with a corresponding expansion of electrical goods and apparatus (or material so classified) imported from abroad.

No telegraphic or tramways material appears in the month's returns, which also do not indicate any marked change in the more prominent purchasing or importing countries.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telephone material and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark	405	431	44	60	17	1,107	...	...	...	204	...
Germany	373	625	8	12	370	235	62	...	26	...	...
Netherlands	8	582	293	...	...	127	8	...	...	...	...
Dutch Borneo and Java	5	...	10	8	...	...	...	...	...	...	...
Belgium	23	...	171	...	30	911	...	...	97	...	...
France	708	...	29	4	...	3,428	70	...	...	5	...
Portugal, Madeira & Portuguese Africa & India	118	1,240	946	23	1,457	1,079	28	...	77	...	...
Spain and Canary Isles	43	305	32	11	...	588	...	...	6	...	...
Italy	76	...	15	2	803	1,639	...	...	...	...	...
Greece and Roumania	7	...	...	...	...	25	...	...	...	19	...
Tunis and Morocco	...	...	...	...	31	58	...	...	...	...	...
Egypt	88	185	15	72	56	297	...	31	72	5	...
China and Siam	65	97	720	66	12	919	...	...	...	24	...
Japan	237	4,855	17	...	252	3,268	200	...	...	...	...
U.S.A. and Cuba	271	...	248	6	18	917	...	...	...	...	...
Mexico, Panama, Columbia, Venezuela & Uruguay	...	...	5	6	...	319	12	...	11	...	...
Chili	64	...	49	84	75	15	84	...	...	...	...
Brazil	96	...	35	4	...	3,493	2	...	189	...	...
Argentine	265	2,361	1,672	259	131	3,680	77	7	323	5,505	...
Channel Isles, Gibraltar and Malta	151	2,208	45	...	...	50	60	...	...	...	...
British West Africa	5	92	11	6	...	2	14	...	8	...	...
Cape of Good Hope	932	1,474	1,411	231	135	1,736	262	12	112	15	...
Natal	1,216	471	2,165	681	501	5,210	917	23	21	1,053	...
British East Africa, Mauritius and Aden	1,613	102	282	17	2	...	20	1	25	...	...
India	2,258	3,365	1,847	971	331	15,933	68	23	25	1,118	...
Burmah	39	13	...	...	4	10	3	42	8	...	...
Ceylon	61	186	246	2	...	12	31	...	...	...	...
Straits Settlements	56	977	140	101	176	1,814	12	6	2	2,065	...
Hong Kong	65	257	225	17	20	...	21	...	...	...	...
West Australia	673	329	171	211	115	42	329	9	32	6	...
South Australia	1,600	57	198	...	...	121	38	...	...	...	...
Victoria	754	957	...	70	162	138	33	...	...	75	...
New South Wales	1,422	529	148	160	83	612	61	3	...	...	...
Queensland	50	144	...	...	...	748	...	...	69	...	...
Tasmania	32	...	...	...	...	...	...	...	...	...	...
New Zealand	282	3,755	663	29	26	357	175	...	10	...	...
Canada	5	...	71	8	25	25	...	...	...	...	...
Brit. West Indies, Brit. Guiana & Brit. Honduras	...	43	...	...	28	134	...	...	19	...	...
Total, £	14,066	25,640	11,932	3,121	4,860	49,059	2,587	157	1,132	10,094	...

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	
Russia, Norway, Sweden and Denmark	285	...	...	116	...	1,950	53	...	8,854	...	...
Holland	11,355	2,417	3,104	322	...	70	...	7,271	13	...	...
Germany	7,899	5,501	1,883	4403	118	11,071	723	245	1,951	40	...
Belgium	8,833	160	...	6,231	16	2,167	23	790	2,004	...	...
France	7,667	452	1,019	145	524	3,013	706	2,196	...	...	...
United States	5,873	802	294	727	80	22,999	21	726	...	43	...
Canada	...	...	...	...	...	1,700	...	...	...	...	...
Total, £	41,912	9,332	6,300	7,981	738	42,970	1,526	11,228	12,822	83	...

Additional Imports: Italy, insulated wire, £30; and Austria-Hungary, carbons, £80.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	2,363	15	244	20	91	2,664	30	273	2,607	447	...

Total Exports:	Total Re-Exports:	Total Imports:
£122,648	£8,754	£135,002

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Combined Vice and Shaping Machine.

Messrs. Fish & Co., of Park Road, Wellingborough, are supplying a patent combined fitters' bench vice and shaping machine, which we show in the accompanying illustration (fig. 1). Among other features of this device may be noted the means adopted for sliding the shaping machine out of the way of the workman when the machine is not in use, and the fact that all parts are interchangeable. The

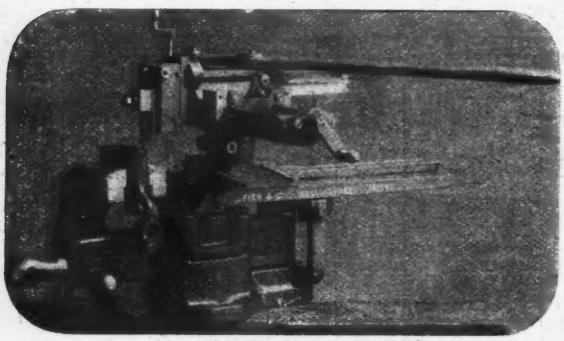

Fig. 1.—Combined Bench Vice and Shaping Machine.

parallel vice which may be of any well-known construction; it is provided at the back with a slide, which is attached by an ordinary bolt, or may be formed integral with the same. The slide has vees, on which a veed plate or saddle is adapted to move, the upper part of the saddle being provided with a socket, into which the stalk of a cross slide fits.

Upon this cross slide is a second veed plate or traverse block provided with other vees at right angles, and in which the tool arm slides, this tool arm being provided at its forward end with a tool-holder formed in the usual manner to enable the tool to be raised and lowered. The tool arm is preferably operated by means of a hand lever pivoted to the tool arm and to a link which, at its opposite end, is pivoted to the traverse block.

In order to feed the tool laterally across the work, the traverse block is provided at one end with a ratchet wheel and a pawl. The ratchet wheel has an extending boss which is threaded on to a screw carried in the cross slide, and the pawl is pivoted to a plate, which in turn is mounted on the boss of the ratchet wheel, the said plate working close up to the side of the wheel in order that the pawl may come over and into engagement with the teeth of the wheel. The plate is operated by means of a pin which may be fixed in any position along a vee groove in the side of the tool arm by a bolt and nut. The upper end of the plate is provided with a vee-shaped opening, so that as the tool arm is moved backwards and forwards, the pin will ultimately engage the sides of the opening and rock the plate, thus rocking round the ratchet wheel on the stationary screw and consequently moving the traverse block laterally on the cross slide. A winch handle may be used on the squared end of the screw to rapidly bring the tool into position laterally, and a lock nut may be employed to hold the screw stationary for the automatic feed.

The pawl and ratchet wheel for the cross traverse are so constructed that the tool may be fed either to the right or left as desired.

In operating the machine the work is held between the jaws of the vice, and the shaping attachment is moved along the slide and fastened in a suitable position on same by means of screws. By means of a winch handle on the end of the screw, the tool and traverse block are moved into alignment with the work, after which the nut may be turned to lock the screw. The cross slide is next brought up to the required height and turned to any desired angle, the stalk being then fastened in the socket by means of the bolt. The tool may be moved backwards and forwards across the work by means of the hand lever, the pin (being set in the groove at a position according to the stroke of the tool arm) engaging the plate at each stroke to feed the tool laterally as described.

This device is intended for use in large or small workshops, on outdoor work, on board ship, &c. It is so arranged that it does not prevent the vice from being used in the ordinary way, and it is claimed that it is so very quickly brought into position that it not only takes the place of the file, but does its work much better and quicker; it is fitted with a graduated tool-holder; the cross slide can be swivelled for taking cuts at any angle across the jaws of the vice, and can be raised or lowered to suit the work; and it has a self-acting traverse of 10 in. with a 6-in. stroke.

The shapers are supplied either with or without the vice, and they are suitable for either 4, 5, or 6-in. jaw vices.

Artistic Electric Light Fittings.

We have had an opportunity of inspecting the art metal work showrooms in London of Messrs. Jesson, Birkett & Co., Ltd. The firm can boast of a very lengthy connection with artistic design and manufacture in metal, and the experience of this kind that they have secured in general decorative directions has been of invaluable assistance to them during several years past, while they have been devoting special attention to the production and perfection of a line of fittings for electric lighting service. The showrooms are situated at 27, Ely Place, Holborn Circus, E.C., where Mr. H. C. Hawkins, who, by the way, is no stranger to the electric fittings trade, is London manager. The firm's manufactory is at St. Dunstan's Works, 7, St. Mary Ann Street, St. Paul's Square, Birmingham. From a walk through the showrooms one can see that wrought and hammered work, correct in design and

Fig. 2. Fig. 3.

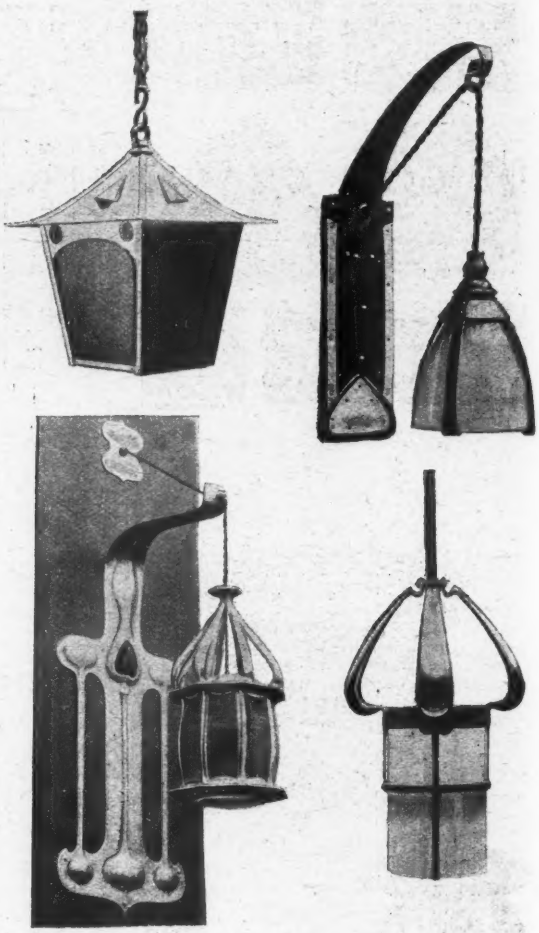

Fig. 4. Fig. 5.

Jesson-Birkett Electric Fittings.

excellent in finish, is the firm's speciality. Among the variety of examples which are placed on view, the more interesting and noteworthy are those inlaid with pearl, or inlaid and riveted with aluminium, and a bracket in which the switch itself forms part of the fitting design. The showrooms, however, are not confined to electrical requirements, for architects and contractors might make a note of the fact that their clients can at the time of their visit select all the other art metal work for ensuring harmony with electric fittings in the decoration of their rooms—such as bell fittings, door plates, and bedroom door knockers. The firm manufactures in copper, brass, aluminium, or if desired, in the precious metals. It has already established a hold upon the electrical market, as is evidenced by the fact that quite recently a large batch of electroliers, brackets and switch-covers, specially designed for one of the most important buildings in Cape Town, has been dispatched to meet a South African order. The American market and the Continent, too, are big buyers in all the firm's art-metal departments, and, whatever may be happening in connection with some classes of industry, customers from those parts of the world are frequently testifying to the very superior position of English art-metal working as compared to the accomplishments of their own countries. We hope that the continual advances that are being made by our representative manufacturers, with their unique experience and efficient skilled hands, will ensure the permanence of British supremacy in this department. In the Birmingham showrooms there is also, of course, a large selection of fittings to be seen, while it may be added that the firm is always willing to submit special designs for any kind of metal-work from a single electric light bracket or finger-plate to the entire metal-work necessary for a modernly appointed residence.

We might say a good deal about the various designs that Messrs Jesson, Birkett & Co. have placed before the trade, but we think that such information will be more readily conveyed by illustrating a few of them, so that they can speak for themselves. In the small catalogue of designs of some 50 to 60 pages, many more may be seen, but we understand that the firm has a larger and complete catalogue in course of preparation for issue shortly.

Pendants and brackets fitted with horn and set with enamels, electroliers, inlaid with pearl or with enamelled roundels, brackets fitted with curtains, table lamps of unusual designs, lanterns with Ambetti glass, combined table lamp and brackets, pendants with flounces—these are some of the features of the current list, to the users' requirements, and produce an excellent effect. Figs. 2 and 5 are representative examples of lantern fittings, figs. 3 and 4 being specimens of bracket work; in fig. 3 the back is inlaid and riveted with aluminium. Some fine work in electroliers appears in figs. 8, 9 and 10.

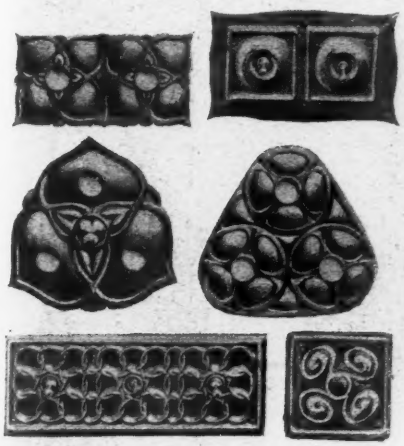

Fig. 6.

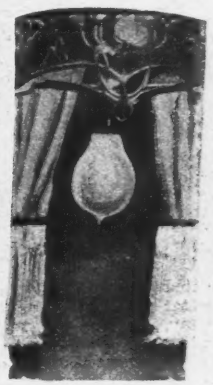

Fig. 7.

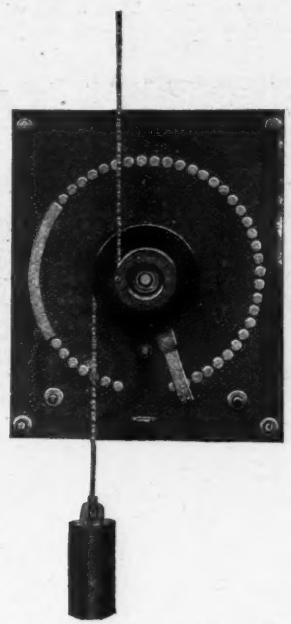

Fig. 11.—Marples Organ Blowing Apparatus.

Fig. 8.

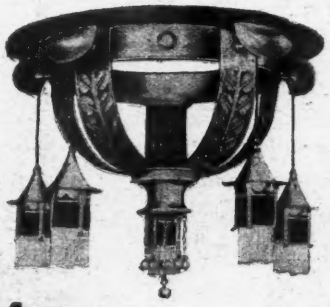

Fig. 9. Fig. 10.

Jesson-Birkett Electric Fittings.

and they are made in either brass or copper, polished or bronzed, or in oxidised silver.

In the accompanying illustrations we show in fig. 6 some ornamental designs in electric bell and switch covers. Fig. 7 is a unique bracket fitting, with curtains, which render it accommodating

The Marples Organ-Blowing Regulator.

The accompanying illustration shows the Marples patent organ-blowing regulator, which is being supplied by Messrs. Marples, Leach & Co., of 6, Victoria Avenue, Bishopsgate Street Without, E.C. It has been produced to simplify the starting of electric motors used for organ-blowing work. A good deal of trouble has been experienced, due to the fact that organists being non-technical men, are unable to appreciate the fact that a starting switch has to be operated slowly, and if some slow starting device is introduced, the time occupied in cutting out the resistance may be an annoyance; besides this, the apparatus is somewhat unsightly, if placed in a convenient position near the organist's seat. It will be seen from the illustration that the regulator is provided with starting and regulating contacts, and that over an angle of about 90° the motor will run at full speed. When the reservoir is empty the contact lever will rest upon the first starting contact; the motor is switched on by closing the circuit by a switch placed in a convenient position for the organist; the motor then begins to revolve, and as soon as the smaller reservoirs in the organ are full, the contact arm revolves around the regulating switch, until it comes into the full speed position; the bellows rapidly rise, and then cut in resistance on the other side, until the motor is brought to a standstill. It is claimed that with this regulator the motor runs at full speed when the reservoir has fallen only half the total distance, and it remains running at full speed until the reservoir is down to within a quarter of its total capacity, an advantage that will appeal to engineers. The makers have recently carried out several installations with this apparatus, amongst the more important being an equipment which has been fitted at Christ's Hospital, Horsham, consisting of two motors and regulators.

PROCEEDINGS OF INSTITUTIONS.

The Measurement of High Frequency Currents and Electric Waves.

By Prof. J. A. Fleming, M.A., D.Sc., F.R.S.

(*Abstract of Cantor Lectures delivered before the* Society of Arts *November 27th, et sqq.*)

The first matter which must engage our attention is the measurement of electric capacity. When a charge of electricity is given to a conductor, the result is to raise what is called its potential, just as when a quantity of heat is imparted to a body, the result is to raise its temperature, or when a quantity of water is put into a vessel the result is to raise the level of the water.

There are certain regular forms of conductors for which the electrostatic capacity can be calculated. These are the sphere, a circular disk, an ellipsoid, a long straight wire, &c. Table I. shows the mathematical expressions for some of these capacities in electrostatic units (E.S.) and in micro-microfarads (m.mfds.).

TABLE I.

Capacity of	In E.S. units.	In m.mfds.
Sphere	R	10 R/9
Disk	2 R/π	20 R/9π
Vertical wire	$l/2 \log_\epsilon 2h/d$	$l/4 \log_{10} 2\ h/d$
Horizontal wire	$l/2 \log_\epsilon 4h/d$	$l/4 \log_{10} 4\ h/d$
Parallel plates	A/4πt	10 A/36πt
Concentric cylinders ...	$l/2 \log_\epsilon \frac{D}{D'}$	$l/4{\cdot}15 \log_{10} \frac{D}{D'}$

The letters in the above formulæ signify as follows:—

l = length of conductor.
R = radius of sphere or disk.
d = diameter of wire.
h = height above the earth.
D = diameter of the sphere, disk or cylinder.

The proximity of any other conductor, even the earth, raises the capacity of the conductor. A large sphere hung up in a room would have a capacity numerically greater than its radius when reckoned in electrostatic units, by reason of the proximity of the walls of the room.

The only method of finding the capacity of most insulated conductors is to do it experimentally. If we charge the conductor to a known potential and discharge it through a galvanometer, say, 100 times per second, these numerous discharges are equivalent in effect to a continuous current. Suppose the galvanometer has been calibrated so that we can ascertain the current in microamperes. Let A be current in microamperes, C capacity in microfarads, V = voltage and N the number of discharges per second, then A = C N V. Hence C can be determined.

The rotating commutator used for this purpose consists of a barrel or drum driven by an electric motor. The connections are shown in fig. 1.

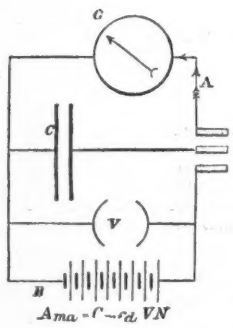

FIG. 1

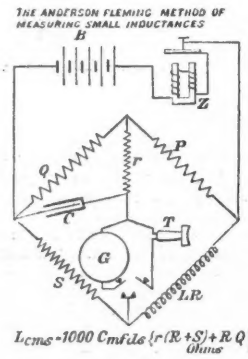

FIG. 2.

Again, by the same appliance, we can determine quite easily the capacity of a Leyden jar, or of a parallel plate air condenser, or of a parallel plate condenser having between its plates a sheet of any solid dielectric. We can make use of the above-described commutator to measure the electrostatic capacity of an aerial wire, as used in wireless telegraphy, by simply connecting the insulated wire to the middle brush. Such an insulated wire constitutes a form of Leyden jar, of which the earth is the outer coating, and the space round the wire the dielectric.

In making such a measurement, however, we have to determine the capacity of the commutator itself, and to subtract this from the total capacity as measured. Operating with this appliance, we find the capacity of a Leyden jar, which is commonly called a pint size, may be about 1/700 of a microfarad, whilst the capacity of a wireless telegraph antenna 100 feet in height, constructed of a wire 1/10 of an inch in diameter, may be about 1/5000 of a microfarad.

Experiments with the commutator show that if a number of wires are hung up parallel to one another in the air, the capacity of the whole of the wires taken together is much less than the sum of each of them taken individually when the others are removed.

The value of the inductance of a circuit can be calculated for certain simple cases, just as the capacity can be determined. If the wire is not made of magnetic material the inductance depends only on the size and shape of the wire, and is measured for our present purposes in centimetres, or in larger units called microhenrys, each of which corresponds to 1,000 centimetres.

The mathematical processes by which these calculations can be made are somewhat complex, but in Table II. are given the values of the inductance L for a number of cases with which we are concerned in practice, such as a straight wire of length l and diameter d, the same wire bent into a circle of perimeter l or into a square of perimeter l, or into a rectangle, the sides of which are respectively a and b.

TABLE II.

Inductance of Various Standard Forms of Circuit.

Straight wire ... $= L = 2l\ (2{\cdot}303 \log_{0} 4l/d - 1)$ cm.
Circular wire ... $= L = 2l\ (2{\cdot}303 \log_{0} 4l/d - 2{\cdot}45)$
Square wire ... $= L = 2l\ (2{\cdot}303 \log 4l/d - 2{\cdot}85)$
Two parallel wires $= L = 2l\ (2{\cdot}303 \log 2D/d)$
Rectangle ... ... $= L = 4\ [(a + b) \log_\epsilon \frac{4ab}{d} -$
$a \log_\epsilon (a + \sqrt{a^2 + b^2}) -$
$b \log_\epsilon (b + \sqrt{a^2 + b^2}) +$
$2\sqrt{a^2 + b^2} - 2(a + b)]$.

In general, the only method of determining the inductance of a circuit is to do it experimentally. One of the most convenient means of carrying out this measurement is by a bridge measurement suggested by Prof. Anderson and modified by myself. In this method we make the conductor, the inductance of which is to be determined, one arm of a Wheatstone bridge and complete the circuit as shown in fig. 2. A variable resistance r is placed in series with the galvanometer, and a condenser C connected between one terminal of the bridge and of the galvanometer. In the circuit of the battery is placed a buzzer or electro-magnetic interrupter Z, which breaks and makes the circuit of the battery very rapidly, say, from 200 to 300 times per second, and a telephone T is placed in the bridge circuit, which can be substituted for the galvanometer G when required.

The first step is to balance the bridge for steady currents. This is done by employing the galvanometer in the bridge circuit and stopping the buzzer. When the measuring arm of the bridge has been so adjusted that the galvanometer shows no current, the battery key being held down, we know that the relation which holds good between the four arms of the bridge P, Q, R and S is that P/Q = R/S. We then set the buzzer in operation and substitute the telephone for the galvanometer, and alter the value of the resistance r in series with the galvanometer until the telephone yields no sound. If then C is the capacity in the bridge reckoned in microfarads, the inductance L in centimetres of the conductor being tested is given by the formula:—

$$L = 1{,}000\ C \left\{ r\sqrt{R + S} + R\ Q \right\} \text{ centimetres,}$$

where C is the capacity of the condenser in microfarads, and P, Q, R and S are the bridge arm resistances in ohms. L is the inductance of the arm of the bridge, of which the resistance is R.

In making this measurement of inductance, the capacity which must be employed in the bridge circuit has to be selected with reference to the magnitude of the inductance being measured.

Another important measurement is that of the mutual inductance of two circuits. If one circuit acts inductively on another the mutual inductance M of the two circuits is measured by the electromotive force produced in the secondary circuit when a current of unit strength in the primary circuit is started or stopped uniformly in one second. We may define this quantity by saying that the electromotive force produced in the secondary circuit by an alternating primary current is 6·28 times the frequency multiplied by the product of the primary current and the mutual inductance M. If we have two coils of inductance L and N, which form primary and secondary circuits of a transformer, we can join them up in two ways; first, so that a current flows the same way round both coils, or, secondly, we may join them up so that a current may flow in opposite senses round the two coils when these are joined in series. It is easy to show that in the first case the whole inductance of the two circuits is L + 2 M + N, and in the second case it is L − 2 M + N. Hence the difference of these two inductances, divided by 4, gives us the value of the mutual inductance. We can, therefore, determine the mutual inductance of two circuits by making two measurements with the above described bridge and telephone, and can thus easily measure small mutual inductances.

Lord Rayleigh has given a well-known formula for tabulating the high-frequency resistance R′, of a nearly straight conductor of length l, of which the steady resistance is R ohms, for high-frequency currents of frequency n. If the metal is non-magnetic, the formula is—

$$R' = \sqrt{R \pi n}\ l,$$

and for a round-sectioned copper wire of diameter d the above formula becomes—

$$R' = R \frac{\pi d}{2} \sqrt{n},$$

where R′ is the high-frequency resistance, R the ordinary steady resistance, and l the length of the conductor. We find then that for high frequencies the value of R′ is very different from R. Thus, for instance, with a frequency 10^6 and a diameter of one centimetre, R′ is nearly 40 R. On the other hand, if d = 1/40 centimetre, which is the size of No. 36 S.W.G., then for the same frequency R′ = R. It is important to notice that the above formula only applies to straight or nearly straight wires.

In making high-frequency circuits, all the conductors should be made of very thin strips of metal or of fine silk-covered wires bunched together, and then the value of the high-frequency resistance is known, being equal to the steady resistance.

If we have in series an induction coil, spark gap, and condenser, we can measure the potential to which the condenser is charged, and the capacity of the latter, and if we can determine the number of sparks per second, we can tell the power in watts given to the condenser, because this latter is equal to $\frac{1}{2}$ N $\frac{c}{10^6}$ v^2, where N is the number of discharges per second, c is the capacity in microfarads, and v the charging potential in volts, the resulting power being given in watts.

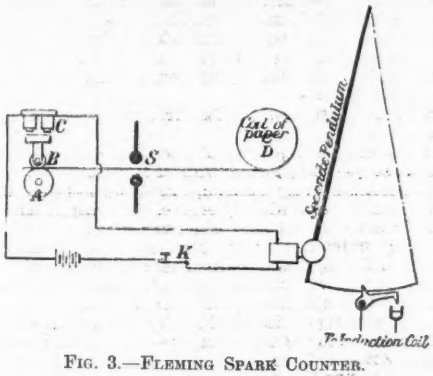

Fig. 3.—Fleming Spark Counter.

I have devoted particular attention to the construction of an instrument intended to effect this measurement. The instrument is constructed in the following manner:—A small electric motor has a flanged pulley put upon its shaft, over which lies loosely a strip of telegraph paper tape, the pulley being just wide enough to allow the paper to lie on it. Over the pulley of the motor rests a jockey pulley, carried at the end of a long weighted rod, which is upheld by an electro-magnet. As long as the jockey pulley is held up, the paper tape will not travel when the motor revolves, but when the jockey pulley is dropped, the paper is gripped, and travels with a speed determined by the speed of the motor. This paper tape is made to pass in part of its course between two spark balls, and at every oscillatory spark it is pierced with a hole. The primary circuit of the induction coil contains a switch which can be closed by an electro-magnet. This electro-magnet is operated by a pendulum (see fig. 3) so arranged that when the pendulum takes one swing, occupying a period of one second, it breaks an electric circuit and then makes it again for exactly one second, and this interruption is caused to drop the jockey pulley on to the motor pulley for one second, and at the same time to close the induction coil circuit also for one second.

When the operation is over we find, therefore, that the paper tape is perforated with a number of holes which correspond to the number of sparks per second, that is, to the number of oscillatory discharges. Accordingly we have the means of reckoning the value of the letter N in the above formula.

The spark gap resistance is found to be a function of many quantities. It depends first upon the length of the spark, increasing very rapidly with the length. In the second place, it varies with the quantity of electricity stored in the condenser and released at each discharge, the spark gap resistance decreasing with increasing discharge current. In the next place, it depends somewhat on the inductance of the circuit, and upon the frequency of the sparks; moreover, a careful examination of the subject of the spark gap resistance, shows that the resistance of the spark is not constant over the whole operation of the spark, but increases towards the end of the discharge as the oscillations die away in amplitude.

Prof. Slaby, of Berlin, has made some interesting experiments on spark resistance. Some of his observations are given in Table III., and plotted out on the curves in fig. 4.

Table III.—Measurement of Spark Resistances. (Slaby.)

Spark length in mm.	Spark resistance in ohms for various capacities c in electrostatic units in the circuit.			
	c = 120.	c = 360.	c = 600.	c = 1,100.
1 mm.	2	0·4	—	—
2 ,,	4	1·0	0·25	—
3 ,,	7	2·7	1·0	0·4
4 ,,	—	5·0	2·5	0·8
5 ,,	—	7·5	5·0	2·0
6 ,,	—	—	7·2	4·2
7 ,,	—	—	—	6·5

I have repeated Slaby's observations in the Pender Electrical Laboratory, of University College, London, with some slight modifications. In place of the carbon rheostat, which I found liable to heat, I used a U-tube containing dilute sulphuric acid, having in it two movable pistons, by means of which the length of the column of sulphuric acid in it could be varied (see fig. 5). A thermometer, placed in this tube, served to give the temperature, and from the known resistivity it was possible to estimate the resistance for any position of the pistons. In place of short-circuiting the spark gap by a tube of sulphate of copper, I employed an inductance coil, and so arranged the ammeter that it measured only the current passing through the spark to be measured. These experiments were made with spark balls of different materials, and it was found that for lengths of spark gap greater than two millimetres, there was a very decided difference between the resistance of sparks taken between iron balls and those between brass or zinc balls of about three centimetres in diameter (see fig. 6). For spark lengths of about five or six millimetres, the resistance of spark between iron balls is nearly double that between zinc balls of the same size; this is no doubt connected with the greater infusibility of iron.

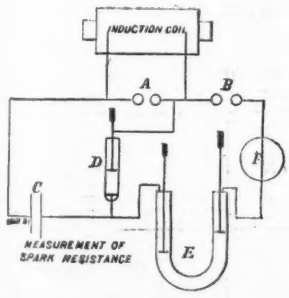

Fig. 5.

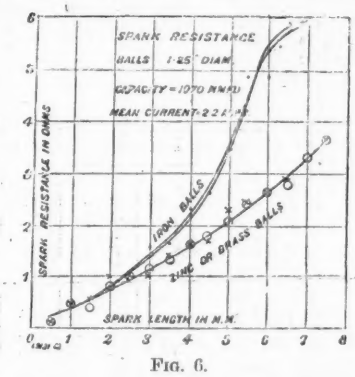

Fig. 6.

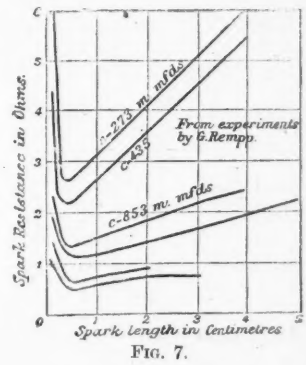

Fig. 7.

Further experiments on spark gap resistance have recently been made by Rempp. He employed rather long spark gaps, and took a spark between zinc balls varying in diameter from one-and-a-half to five centimetres. His results show that the spark resistance has a minimum value corresponding to a spark length of about four or five millimetres, the spark resistance increasing for shorter spark lengths, and also for longer spark lengths (see figs. 7 and 8).

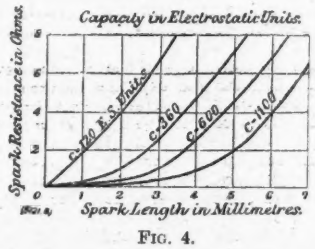

Fig. 4.

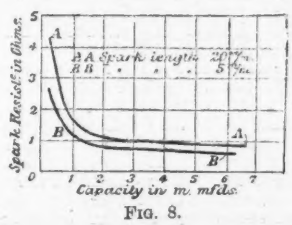

Fig. 8.

I have made some interesting researches on the phenomena of the spark when using an alternating-current transformer having a frequency of about 50. I find that so far from there being a spark per alternation in some cases there were far fewer than 50 sparks per second; and in some cases a far greater number. When using very short spark gaps, I found it was necessary to insert inductances between spark gap and transformer to destroy the alternating arc. Under these circumstances the oscillatory discharges sometimes rose to 500 per second. The explanation is as follows:—The

inductance used to quench the arc causes a drop in voltage, when a current passes; the instant before discharge the transformer gives a certain voltage, and the condenser is charged to this voltage; if this exceeds the voltage due to spark gap length, a discharge passes, and the voltage drops in consequence of the inductance inserted between the transformer and spark balls. The discharge then ceases, but it immediately recommences, and five or six discharges may take place in one semi-period. If, however, the condenser capacity is very large, it may require several complete periods of the transformer current before the P.D. is sufficient to break down the resistance of a long spark gap.

(To be continued.)

Electric Winding Considered Practically and Commercially.

By W. C. MOUNTAIN, M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, January 16th*, 1906.)

THERE is no doubt that in the past the class of winding engines used in collieries have been very far from economical. But colliery owners are now recognising the importance of reducing the consumption of coal in their collieries. The writer has found that the consumption of coal used for the winding engines, pumping, hauling, screen driving, and the other requirements have been as high as 13 per cent. of the total output of coal produced by the colliery, whereas in modern collieries the consumption has fallen to about 2 per cent.

In a large number of collieries there is a very considerable amount of coal produced, either in the form of slack, dust, or smudge, which is practically unsaleable; this coal is usually used under the boilers, and, as it is practically valueless, any saving which can be effected in the cost of working, by reducing the consumption of coal, has to be considered upon the market value of such coal.

Of course, there are other savings, such as the reduced number of boilers, also stokers and ashmen, which all have to be taken into account, but, after all, when considering any change in the system of winding in an existing colliery, or the application of winding to a new colliery, it becomes a question of at what cost 100 tons of coal can be wound by the different systems.

In dealing with the question of electric winding from a practical standpoint, the great difficulty which at once presents itself is the enormous amount of current and consequent power which is required for acceleration, compared with the average quantity of current or energy required throughout the wind, and this becomes a matter of very serious consideration when it is necessary to accelerate very quickly in order to get the output from the colliery.

At the Preussen II. Colliery, near Dortmund, there are three 550-KW. three-phase generators, working at 2,100 volts, 25 cycles per second. When winding is going on, two of these are kept running; but as the motor is coupled directly to the power mains through its starting switches, the pressure various enormously, though the average load is not great.

At Zollern II. Colliery there are two 1,100-KW. D.C. generators working at 525 volts; the average load on one generator is 750 KW. The winding gear is driven by D.C. motors of 750 H.P. each, fed through a motor-generator on the Ilgner principle, with a fly-wheel weighing 45 tons, and running at a peripheral speed of 14,000 ft. per minute. The motor driving this fly-wheel is rated at 300 H.P., the generator at 1,000 KW. The variation in the demand on the generating plant is small, the load ranging from 130 to 235 KW. on the motor side, while the voltage does not vary 5 per cent.

The following readings were taken from the various meters on the switchboard during ordinary working hours; the whole plant at the colliery is operated by electric motors.

	Amperes.	Volts.	E.H.P.
Coal washery	200	520	140
Condenser	24	520	16
Ventilating fan	100	520	870
Air compressor	430	520	300
Workshops	10	520	7
Motor-generator of winder ...	300	520*	240
Totals	1,064	520	773

* Average of readings.

Consequently the entire colliery, including the winding engine, requires only an average load of 773 H.P. when winding from 1,000 to 1,500 tons per day, from a depth of 984 ft. (300 metres). The coal consumption to do the whole work at the colliery can be calculated from the dimensions of the engines and the horse-power shown by the meters, and it was about 2 to 2½ per cent. of the output.

The writer has not received from the manufacturers of the winding plants described any actual figures as to cost, but his own rough estimate of the value would be as under:—

Preussen Plant.—Two sets of compound engines with 550-KW. generators, main switchboards, connecting cables, winding gear with switches and controlling apparatus, £15,000 to £16,000.

Zollern Gear.—Including proportion of value of one generator set, switchboards, cables, motor-generator, winding gear, controlling apparatus, about £20,000.

Both these installations were, however, carried out in a somewhat elaborate manner.

When approaching the question of electric *v.* steam winding, it is not desirable to start off at once with the assumption that steam winding is necessarily very wasteful, and to take as a standpoint a very uneconomical steam winding engine. This has, unfortunately, been done by some in the past who have written papers on this subject. The writer has, by the kindness of many friends connected with collieries, obtained actual data as to the consumption of coal per 100 tons wound, winding engine man, stokers' and ashmen's wages, which are embodied in a table.

The cost of winding varies considerably. The cheapest, 3s. 11d. per 100 tons, is due to the large output—viz., 3,186 tons—which is wound in 11 hours, and the coal in this case is valued at only 3s. per ton. Comparing this with a case where the output is 3,360 tons in 14 hours, and the value of the coal used for winding, 1s. 6d. per ton only, the cost works out at 5s. 2d. per 100 tons, but this is due to the more expensive winding engine.

In one colliery the cost works out at 16s. 11d. per 100 tons wound, but this is with an engine 30 years old, and to arrive at this figure the original value of the engine when new is put in. With the depreciated value, the cost per 100 tons would be considerably less.

The conclusion to be drawn is that, with reasonably economical engines, coal can be wound, including interest and depreciation, at from 6s. to 7s. per 100 tons, and where the coal used is of very little value, this cost can be still further reduced.

With really high-class steam winding engines, the principal makers are prepared to guarantee the results, which are shown in the accompanying table:—

ESTIMATED COST OF WINDING FOR 100 TONS WITH HIGH-CLASS COUPLED HIGH-PRESSURE NON-CONDENSING ENGINES—STEAM PRESSURE, 150 LB.—MADE BY MESSRS. FRASER & CHALMERS, LTD., ERITH.

	Coal in tons per day of eight hours.	Depth of shaft in yards.	Weight of coal per wind in tons.	Number of winds per day.	Time of winds in seconds.	Maximum velocity in feet per second.	Rate of acceleration in feet per second.	Time of changing in seconds.	Cost of coal per 100 tons wound.	Oil and stores per 100 tons.	Total wages per 100 tons wound.	Cost of plant.	Total cost per 100 tons wound.	
													Without interest and depreciation.	Including interest and depreciation.
I.	1,000	500	2	500	44·2	54·5	4	9	1s. 7¾d.	3d.	1s. 5½d.	£4,325	3s. 4½d.	6s. 9¾d.
II.	1,500	500	3	500	43·8	54·2	4·1	19	1s. 6d.	3d.	0s. 11½d.	£5,100	2s. 8½d.	5s. 5d.
III.	2,000	700	4½	445	49·5	68	5·7	11·2	2s. 3½d.	3d.	0s. 11d.	£9,500	3s. 5½d.	7s. 2½d.
ESTIMATED COST OF WINDING PER 100 TONS WITH HIGH CLASS GENERATING PLANT AND BALANCER.														
I.	1,000	500	2·4	417	49	38	4½	16	1s. 4½d.	3d.	2s. 1d.	£12,800	3s. 8½d.	13s. 9½d.
II.	1,500	500	3·6	417	49	36	6	19	1s. 4d.	3d.	1s. 4½d.	£16,200	2s. 11½d.	11s. 7d.
III.	2,000	700	4·8	417	48	57	6	20	1s. 9½d.	3d.	1s. 0d.	£23,300	3s. 0½d.	12s. 5d.

The above figures are obtained with the engines working high pressure, but there is no doubt that a very considerable economy can be obtained by condensing. Therefore the results of electric winding are shown rather more favourably than they would be if the engines were working non-condensing, the same as with steam winding.

The tables show the cost and also the consumption of coal per 100 tons wound. Interest and depreciation are added at the rate of 10 per cent. for the winding engines and on the boilers.

Another table shows the probable cost of an electric winding plant under typical winding conditions in large collieries.

It will be seen that the figures do not compare at all favourably with the results which have been obtained from high-class steam winding engines, and this is largely due to the heavy first cost of the plant.

When the supply for the electric winder is taken from a power company, the cost of the generating plant is eliminated, and, assuming the value of the coal for producing steam at 3s. 6d. per ton (as taken in the above tables), the cost of labour, interest and depreciation alone exceeds the cost at which coal can be wound with high-class steam winding engines, this result being due to the heavy first cost of the electrical winding gear and balancer.

Compared with the worst examples of steam winding, where the cost works out at 16s. 11d. per 100 tons wound, the amount which the consumer could afford to pay an electric supply company for current would be—

On 1,000 tons, 500 yards deep ... 35d. per unit.
On 1,500 tons, 500 " ... 27·5d. "
On 2,000 tons, 700 " ... 18d. "

But the question would at once arise whether it was not desirable to put in high-class steam winding engines, and wind the coal at a much lower cost than it can be done at electrically.

By the courtesy of the Electrical Co., the writer is able to deal with results obtained at the Grand Hornu New Mine, in Belgium. This colliery is favourably situated (as regards the application of electricity to winding), as there are three pits, all of moderate capacity, placed at some little distance apart.

Data Relating to the Grand Hornu Mines.

Output, tons of coal per day of 24 hours	1,400
Depth of shaft, yards	766⅔
Hours worked per day	24
Tons of coal per hour	58·3
Tons of coal per wind	2·55
Days worked per year	250
Total cost of winding per 100 tons...	£0 19 7¼
Cost of winding per 100 tons, without interest and depreciation	£0 9 11½

The cost of 19s. 7¼d. per ton is only obtained by the plant running 24 hours per day. It run for 10 hours per day, the cost per 100 tons would be much higher and the comparison more unfavourable.

With this up-to-date system of electric winding and with only 4 per cent. interest and 5 per cent. depreciation added, the cost of winding is, roughly speaking, twice what the cost is shown to be from by no means up-to-date steam winding engines in this country.

It must not, however, be inferred that there is no field for the successful application of electricity to winding in small collieries, or to groups of collieries which are dealing with small outputs and very moderate depths, but it does appear that for really heavy work, colliery owners would be ill-advised to spend the large additional sum required for electric winding plant when there is so little prospect of getting an adequate return, and when they can spend their money to much greater advantage in electrifying their haulage, pumping, coal cutting, drilling, and the surface driving arrangements.

WRONG PATENT LAW.

[COMMUNICATED.]

The patent law is wrong, and the recent alterations in it are proving to have made bad worse—and more expensive.

The late Sir Frederick Bramwell, shrewdest and most genial of expert witnesses, used to say that the patent law should be abolished altogether. Certainly, the path of the designer and the engineer would be made easier thereby.

But, for our part, we hold that, in order to stimulate true invention, it is necessary to provide some definite protection for the "true and first inventor," just as it is necessary to give copyright to an author. Both are the owners of what the French call "Intellectual Property." The ideal would be a genuine protection for an original invention for a sufficient term of years to give to the inventor time to reap a reasonable reward.

What is the state of the case to-day, and how do we treat our inventors?

The law of copyright protects an author for the greater part of his lifetime. The life of a patent (when the inventor happens to be wealthy enough to pay the fees for its whole life) is generally just long enough for the owner to spend all his money in making it ready to become a commercial success. To get it renewed is an operation which is recognised as being so expensive and difficult as to be beyond the dreams of avarice, and the attempt is now seldom made.

It is a question for argument whether the nation is any the richer for its patents; but we think it is not open to doubt that patentees as a whole class are much the poorer. The affair is a huge lottery, in which the vast majority lose their little all and the lucky few get fortunes.

A study of the touting circulars issued by patent agents reveals the fact that they almost all rely on the invention of the safety pin (some 50 years ago) and somebody's brass toe clip, as a more recent example, as showing how fortunes can be made by simple ideas, provided only a patent be taken out through their office. One pictures the man with an idea gloating over the figures, and already seeing in imagination a vast crowd of anxious manufacturers, with gold watch chains and spats, crowding round his humble doorstep, each in the hope of securing a license at so many thousands a year irrespective of results.

Usually the patent agent adds that he undertakes the sale of inventions secured through him, provided they appear to him to be of sufficient commercial value. Curiously enough they always do until after the patent is taken out; but we never yet heard of a patent agent who sold a patent. We are far from saying it has never been done, but such a transaction has not come within our experience.

Next, the Government takes "its whack." The Patent Office is run chiefly with a view to raising revenue for other Government departments to spend. No less than £80,000 a year is (or was, before the recent institution of the search for novelty) paid over into the Treasury by the Patent Office. This is nothing more nor less than a tax on brains. In the case of poor inventors it is a prohibitive tariff.

In the United States a first and last payment of £10 down covers 17 years of protection, which is only granted after a competent search as to novelty and validity. The enormous business done by the States in all kinds of ingenious mechanical devices is directly due to their Patent Law.

In this country £99 is wrung from the wretched inventor for 14 years of protection. The whole may be paid in advance (no discount allowed). Otherwise it must be paid in instalments. The Patent Office knows that it exists in order to defeat the inventor (notably rather an absent-minded person) at every opportunity; and, therefore, it sends out no postcards, or other notices or accounts to remind him that his brain-tax is about to fall due. All other kinds of National tax-collectors have to send a demand note.

After the period of grace has passed unnoticed, the inventor is robbed for ever of his "Intellectual Property." But stay; a remedy can be sought in the legislature!

Here is an instance of the working. Five firms in one town had patents, and employed the same patent agent to protect them as far as possible from the depredations of the Patent Office.

He reminded them at their several dates that their brain-taxes were due, and accordingly received the amounts of the same plus half-a-guinea in each case for the exercise of his excellent memory. What firm ever looks to see if its patent agent has paid its money over to the office? They all five took it for granted; and the patent agent took the money, and has not since been seen in his native place.

A solicitor next came into action and invited the five firms to a conference. The patents, which had, of course, all lapsed, were considered sufficiently important for legislation. One hundred pounds each for a joint bill was the lawyer's estimate. The bill was drafted and submitted to the Chairman of Committees of the House of Lords. He thought it was a case for redress; but a joint bill in such circumstances was not in accordance with precedent. (A joint bill involved only one set of House fees.)

This staggered three firms, who withdrew from the enterprise. The other two (more from sheer British doggedness, which our institutions are so well calculated to develop, than from anything else) went on separately; got their "*redress*," and paid about £650 each for it.

One of these firms shortly afterwards had to defend its patent against an infringement. Its solicitor threatened first, and took the opinion of eminent counsel afterwards. Eminent counsel advised amendment. In the meantime the infringer claimed and got "*smart money*" for unsustained threats. Amendment, as settled by eminent counsel, was applied for, and vigorously opposed by the infringer, but granted.

Thus, at long last, the moment for defending the "intellectual property" of the patentee had arrived. Then on the eve of the hearing of the action, eminent counsel said he had changed his mind, and the patent was still invalid, even as settled by himself! He is said to be making an income of such an amount that no mere journalist can think in the figures that are involved. Such is the British Patent Law. What is the remedy?

Again, we can only indicate roughly what might be done. Increase the period of protection to 17 years, or even 20 years. Reduce the fee to £10 down for the whole period. Make the search (already instituted) expert and thorough. Pass no doubtful or ambiguous claim. Assist the inventor to draft his patent clearly, and in such a manner as to define his invention exactly. If such operations cost money, even to the tune of £100,000 a year, flowing back from the Treasury to the Patent office, it would be an investment that would bear a rich harvest.

Institute a Patent Court, with a judge of special qualifications, and no appeal. The present appeal to the House of Lords being too costly for a poor litigant, puts the rich one in possession of the field every time. He wins by sheer weight of metal. If beaten in the lower Court, he has only to give notice of appeal, and that finishes the business, in his favour. The same judge should have power to grant compulsory licences at fair royalties on every patent, thus preventing "lock-up" patents, whether British or foreign. These royalties might be easily based on an *ad valorem* scale, such as, for instance, 10 per cent per annum.

Arrange with the Colonies and India for a standard law throughout the Empire, as to patents, designs, trade marks and copyright. It might well be managed to give free protection and registration to Colonial and Indian patents in exchange for similar treatment throughout the Empire for British patents. That would be a real and beneficial tightening of the "bonds of Empire," and would raise the value of British bonds in general.

In fine, let the Patent Office be run not as a department for taxing brains and issuing "licences to be shot at," but let every assistance, encouragement and protection be given to invention, with clear and full public benefit all the time, and not only after the invention falls into the public domain. Patent agents, solicitors, experts, eminent counsel, officials of the Government, would all howl loudly enough, no doubt; but the electrical and other engineering trades would jump —in the Official List of the Stock Exchange—for joy.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

18,673A/05. "Improved electric terminal." O. Millauro. (Date applied for under Rule 5 of the Patents Rules, 1905, September 15th, 1905.) January 13th. (Complete.)

18,673B/05. "Improved electric switch." O. Millauro. (Date applied for under Rule 5 of the Patents Rules, 1905, September 15th, 1905.) January 13th. (Complete.)

481. "Improvements in devices for the measurement of X-rays." W. I. Bruce and E. Sanger-Shepherd. January 8th.

514. "Improvements in and relating to electric measuring apparatus." The British Thomson Houston Co., Ltd., and F. Holden. January 8th.

515. "Improvements in and relating to electric measuring apparatus." The British Thomson-Houston Co., Ltd., and F. Holden. January 8th.

516. "Improvements in and apparatus used in electro-plating." W. A. S. Benson & Co., Ltd., and A. J. Leaver. January 8th.

525. "Improvements in electrical signalling on railways." E. R. E. Rotter. January 8th.

550. "Improvements in electric meters." J. W. Jones. January 9th.

551. "Improvements in electrical conductors." S. Cowper-Coles. January 9th.

557. "An improved electric ceiling rose, switch, or similar instrument." A. H. Gibbins and C. P. L. Titherley. January 9th.

569. "High electric pressure fire alarm system." H Garstano. January 9th.

591. "Improvements in bridge type fuses and distributing boards in connection with electrical work." L. Howell. January 9th.

605. "Improvements relating to dynamos and motors." F. H. Poring. January 9th.

615. "Improvements in telephone holders." C. H. Porten. (Date applied for under Patents Act, 1901, March 1st, 1905, being date of application in United States.) January 9th. (Complete.)

619. "Improvements in the suspensions of current conductors of electric railways." P. Platte. (Date applied for under Patents Act, 1901, January 10th, 1905, being date of application in Germany.) January 9th. (Complete.)

626. "An improved electric light fitting." H. Faraday. January 9th.

631. "Improvements in or relating to incandescent electric lamps, vacuum tubes and the like." J. F. Duke and H. Hirst. January 9th.

632. "Improvements in or relating to incandescent electric lamps, vacuum tubes and the like." J. F. Duke and H. Hirst. January 9th.

642. "Improved process for the electro-deposition of iron." S. Cowper-Coles. January 10th.

646. "Improvements in brush-holders and carriers for electric generators and motors." E. W. Cowan. January 10th.

690. "Switch for combination of magneto and high-tension coil ignition applied to petrol engines through one and the same set of plugs." W. A. B. Copsey. January 10th.

706. "Improvements in controlling means for vapour-electric apparatus." P. C. Hewitt. (Date applied for under Patents Act, 1901, January 20th, 1905, being date of application in United States.) January 10th. (Complete.)

707. "Improvements in alternating-current vapour-electric apparatus." P. Holbrook-Thomas. (Date applied for under Patents Act, 1901, January 27th, 1905, being date of application in United States.) January 10th. (Complete.)

712. "Improvements in arm supports for use with telephones and the like." B. Badmann and A. Modery. January 10th.

735. "Improvements in and relating to controlling devices for electric motors." The British Thomson-Houston Co., Ltd., and J. Sugden. January 10th.

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Vapour Electric Apparatus. British Thomson-Houston Co., Ltd. (General Electric Co.) 7,416. April 7th.

Institute a Patent Court, with a judge of special qualifications, and no appeal. The present appeal to the House of Lords being too costly for a poor litigant, puts the rich one in possession of the field every time. He wins by sheer weight of metal. If beaten in the lower Court, he has only to give notice of appeal, and that finishes the business, in his favour. The same judge should have power to grant compulsory licences at fair royalties on every patent, thus preventing "lock-up" patents, whether British or foreign. These royalties might be easily based on an *ad valorem* scale, such as, for instance, 10 per cent per annum.

Arrange with the Colonies and India for a standard law throughout the Empire, as to patents, designs, trade marks and copyright. It might well be managed to give free protection and registration to Colonial and Indian patents in exchange for similar treatment throughout the Empire for British patents. That would be a real and beneficial tightening of the "bonds of Empire," and would raise the value of British bonds in general.

In fine, let the Patent Office be run not as a department for taxing brains and issuing "licences to be shot at," but let every assistance, encouragement and protection be given to invention, with clear and full public benefit all the time, and not only after the invention falls into the public domain. Patent agents, solicitors, experts, eminent counsel, officials of the Government, would all howl loudly enough, no doubt; but the electrical and other engineering trades would jump —in the Official List of the Stock Exchange—for joy.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

18,673A/05. "Improved electric terminal." O. Millauro. (Date applied for under Rule 5 of the Patents Rules, 1905, September 15th, 1905.) January 13th. (Complete.)

18,673B/05. "Improved electric switch." O. Millauro. (Date applied for under Rule 5 of the Patents Rules, 1905, September 15th, 1905.) January 13th. (Complete.)

481. "Improvements in devices for the measurement of X-rays." W. I. Bruce and E. Sanger-Shepherd. January 8th.

514. "Improvements in and relating to electric measuring apparatus." The British Thomson Houston Co., Ltd., and F. Holden. January 8th.

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516. "Improvements in and apparatus used in electro-plating." W. A. S. Benson & Co., Ltd., and A. J. Leaver. January 8th.

525. "Improvements in electrical signalling on railways." E. R. E. Rotter. January 8th.

550. "Improvements in electric meters." J. W. Jones. January 9th.

551. "Improvements in electrical conductors." S. Cowper-Coles. January 9th.

557. "An improved electric ceiling rose, switch, or similar instrument." A. H. Gibbins and C. P. L. Titherley. January 9th.

569. "High electric pressure fire alarm system." H Garstang. January 9th.

591. "Improvements in bridge type fuses and distributing boards in connection with electrical work." L. Howell. January 9th.

605. "Improvements relating to dynamos and motors." F. H. Poring. January 9th.

615. "Improvements in telephone holders." C. H. Borien. (Date applied for under Patents Act, 1901, March 1st, 1905, being date of application in United States.) January 9th. (Complete.)

619. "Improvements in the suspensions of current conductors of electric railways." P. Platte. (Date applied for under Patents Act, 1901, January 10th, 1905, being date of application in Germany.) January 9th. (Complete.)

626. "An improved electric light fitting." H. Faraday. January 9th.

631. "Improvements in or relating to incandescent electric lamps, vacuum tubes and the like." J. F. Duke and H. Hirst. January 9th.

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642. "Improved process for the electro-deposition of iron." S. Cowper-Coles. January 10th.

646. "Improvements in brush-holders and carriers for electric generators and motors." E. W. Cowan. January 10th.

690. "Switch for combination of magneto and high-tension coil ignition applied to petrol engines through one and the same set of plugs." W. A. B. Copsey. January 10th.

706. "Improvements in controlling means for vapour-electric apparatus." P. C. Hewitt. (Date applied for under Patents Act, 1901, January 20th, 1905, being date of application in United States.) January 10th. (Complete.)

707. "Improvements in alternating-current vapour-electric apparatus." P. Holbrook-Thomas. (Date applied for under Patents Act, 1901, January 27th, 1905, being date of application in United States.) January 10th. (Complete.)

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